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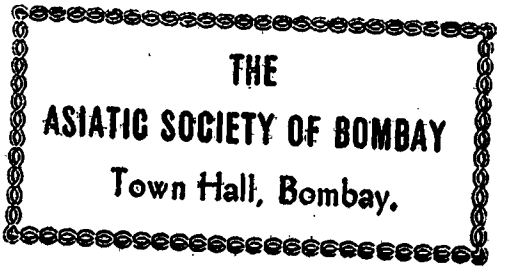

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THE

LAKE DWELLINGS OF SWITZERLAND

AND OTHER PARTS OF EUROPE

LONDON

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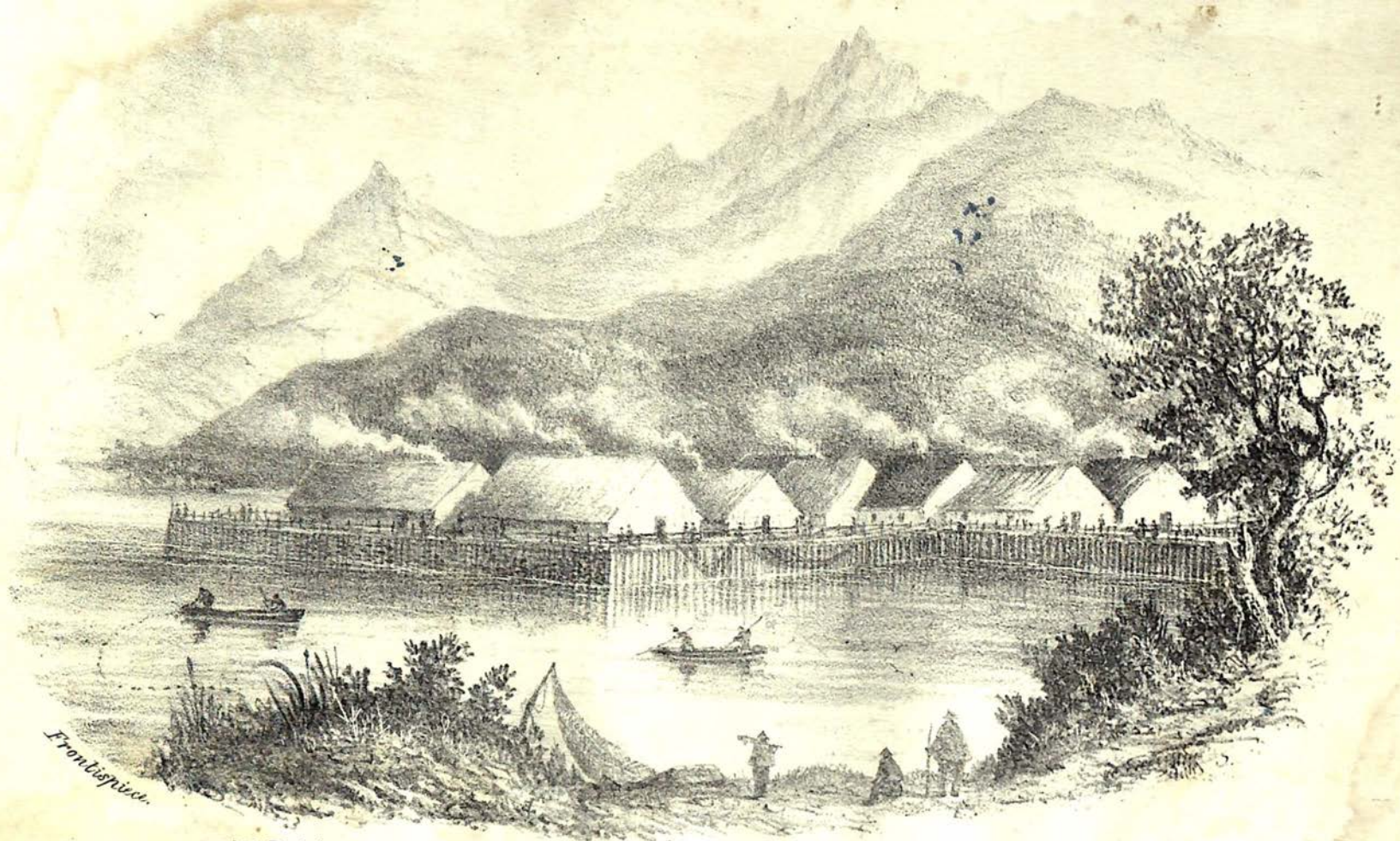

Frontispiece.

IDEAL SKETCH OF A SWISS LAKE-DWELLING.

"Restored" from the latest discoveries.

THE

LAKE DWELLINGS

OF

SWITZERLAND AND OTHER PARTS OF EUROPE

558

BY

DR. FERDINAND KELLER

PRESIDENT OF THE ANTIQUARIAN ASSOCIATION OF ZÜRICH

60531

TRANSLATED AND ARRANGED

BY

JOHN EDWARD LEE, F.S.A. F.G.S.

AUTHOR OF 'ISCA SILURUM' ETC.

R x 6 2

LONDON
LONGMANS, GREEN, AND CO.
1866

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TRANSLATOR'S PREFACE.

WHEN about to visit Switzerland the summer before last, I was naturally desirous of obtaining information as to the antiquities discovered of late years in what have been rightly designated, by a well-known antiquarian friend, as the 'wonderful Pfahlbauten' (Habitations lacustres), or lake dwellings. Some very excellent notices of them had appeared in English by Mr. Wylie, Sir John Lubbock, Bart. (since then printed with additional information in his late work), and Sir Charles Lyell, Bart.; but still there seemed a want of precise and definite information respecting them.

On arriving in Switzerland, I found that the inhabitants were fully aware of the rich archæological mine, which had been first brought into notice by Dr. Ferdinand Keller, the excellent president of the Antiquarian Association of Zürich. The investigation of the various lake dwellings is now carried on with a zeal and energy, which might be emulated with advantage by our own richer and more numerous societies. Almost all the museums of Switzerland now contain valuable collections of these antiquities: there is hardly a native who is not fully alive to the value of these discoveries.

Under these circumstances, it seemed to me a most extraordinary thing that, notwithstanding the excellent general notices before referred to, so little, comparatively, should be known in England respecting them; and I there-

fore, in the autumn of that year, ventured to propose to Dr. Keller, the original discoverer, to make a translation of his reports on this subject to the Antiquarian Association of Zürich, five of which were then published, and the sixth was in progress. To this he most readily and kindly assented; but he advised that, as the reports had been published at various times, when fresh discoveries were made, the whole should be rearranged and thrown into a more regular form. He also very liberally proposed to send lithographic 'transfers' of the plates for his sixth report (which has been published within the last few weeks); and he has also kindly communicated the proof-sheets of it, while in the press; so that the present work will contain the very latest information which has been obtained on the subject.

Such, then, is the nature of this volume. I will merely add, that it is a simple translation and rearrangement of Dr. Keller's six reports: the order is entirely different; the language, as far as possible, is his own. Some few things have, under his direction, been omitted, and several additions have been made by him. In a few instances I have added notes of my own: my province, however, was not to illustrate but to translate; and, as these few notes rest on my own authority alone, they are marked at foot with the letters *Tr.*

With respect to the plates, it may be well to mention that about one-half are actual 'transfers' (rearranged in the octavo form) from plates drawn at Zürich, either for the last report or for the previous ones. Another considerable portion consists of copies, either by myself or my friends, from the other plates of the Zürich reports; while a smaller portion, including the sketches of localities, were drawn by myself from nature, or from the objects themselves, during a visit to Switzerland last summer. It was at first intended that each settlement should have one or more plates to itself; and

this has been carried out as far as possible: but the number of settlements, and the multitude of specimens (upwards of fifteen hundred in all), and more especially the constant discovery of new objects while the translation was going on, rendered it absolutely impossible to carry out this plan entirely. A full index and a careful description of the plates will, it is hoped, obviate any difficulty arising from this circumstance.

I must be allowed a few words respecting the 'Ideal Restoration of a Lake Dwelling,' which is placed as a frontispiece, as it is not the 'restoration' given in the first Zürich report, which has been so frequently copied; and it might be thought presumption in a translator not to have reproduced the original sketch. But the fact is, since that report was published, a great mass of information has accumulated, which required some change to be made in the restored sketch; and Dr. Keller requested me to design a view in accordance with the latest discoveries. This sketch, therefore, before it was drawn on the stone, was submitted to the author of this volume, and corrected by him in some minor particulars; and after having been transmitted once or twice between Zürich and England, I am happy to say it has now his complete approval.

The foreign weights and measures have all been reduced into those of England, except where they were evidently given merely as approximations, in which cases the original numbers have not been altered.

Amongst the multitude of facts which had to be collected from six reports, and placed under their proper heads, some minor mistakes are very probable; but I trust that no great errors will be found. It is not with a view of evading responsibility, but in order to give some authority to the work, that I mention the fact of the proof-sheets having passed rapidly under the eye of the author. I do

not mean to say that he has, what is called, 'corrected the press:' this was more than could possibly have been expected from him; but even a hasty glance from the author and original discoverer will probably ensure its freedom from great errors.

I have further to add, by Dr. Keller's especial request (and I cannot do this better than in the Preface), that in the following volume it has been his object simply to state *facts*: he leaves almost entirely to others the wide field of speculation. The mass of facts already accumulated is large; it is daily increasing; and it would be premature to speculate where the discoveries of any hour may overturn the theories of the previous one.

Lastly, I do not think it out of place to mention how much I am indebted to my lithographer, Mr. Palmer, of Newport, for the care he has taken as to the plates, especially in the troublesome rearrangement of the 'transfers' from Zürich: some of the copies from the Swiss plates were drawn on stone by Mr. Palmer, junior.

In conclusion, I sincerely hope that the reader may enjoy even a small portion of the pleasure which has fallen to my lot while investigating the subject, and translating this valuable work.

THE TRANSLATOR.

THE PRIORY, CAERLEON:
April 11*th*, 1866.

TABLE OF CONTENTS.

	PAGE
TRANSLATOR'S PREFACE	v
TABLE OF CONTENTS	ix
INTRODUCTION	1
GENERAL FORM	3
METHODS EMPLOYED IN COLLECTING THE LAKE-DWELLING ANTIQUITIES	9
ORIGINAL DISCOVERY	10
REMARKS ON THE AGES OF STONE, BRONZE, AND IRON	12
MEILEN	14
MOOSSEEDORF	31
LAKE OF PFÄFFIKON (ROBENHAUSEN, IRGENHAUSEN)	37
WANGEN	60
NIEDERWYL	69
WAUWYL	77
ALLENSBACH AND MARKELFINGEN	87
UEBERLINGER SEE (WESTERN SHORE)	96
(EASTERN SHORE)	102
LAKE OF ZUG	123
NIDAU	132
CORTAILLOD	148
AUVERNIER	153
ESTAVAYER	156
NEIGHBOURHOOD OF YVERDON (CONCISE, CORCELLETTES, ETC.)	168
GRENG	184
MONTELLIER	190
MORGES	194
LAKE OF BOURGET	202
LAKE DWELLINGS SOUTH OF THE ALPS	205

PAGE

MERCURAGO AND BORGO TICINO 210

PEAT MOOR OF SAN MARTINO AND TORRE BAIRO . . . 215

LAKE OF VARÈSE 217

PESCHIERA 218

LAGO DI FIMON 222

CASTIONE AND THE TERRAMARA BEDS 222

EARLY ANTIQUITIES FOUND IN ITALY (for comparison) . . 236

MARIN 239

GEOGRAPHICAL LIST OF LAKE DWELLINGS IN THE SWISS DISTRICT . 264

GENERAL REMARKS ON THE LAKE DWELLINGS 289

FIGURES OF THE CRESCENT MOON 319

MANUFACTURES OF VEGETABLE FIBRE, FLAX, &c. . . . 323

PLANTS OF THE LAKE DWELLINGS, BY DR. OSWALD HEER . . 336

ANIMAL REMAINS OF THE LAKE DWELLINGS, BY PROFESSOR RÜTIMEYER 355

ANALYSIS OF BRONZE IMPLEMENTS, BY PROFESSOR VON FELLENBERG . 363

SETTLEMENTS ON THE MAIN LAND (for comparison) 364

Ebersberg 364

Vilters 375

Uetliberg 376

Windisch 376

BAVARIA 378

MECKLENBURG 378

IRISH CRANNÓGES 380

SCOTCH CRANNOGS, BY JOHN STUART, ESQ 389

APPENDIX 393

Remarks on the '*Habitations lacustres*' of M. Troyon . . 394

Latest Discoveries in the Swiss Lake Dwellings . . 401

EXPLANATION OF THE PLATES 405

INDEX 419

DIRECTIONS TO BINDER.

Place IDEAL RESTORATION OF A SWISS LAKE DWELLING as *frontispiece*, and the remaining Plates together at the end.

LAKE DWELLINGS.

INTRODUCTION.

THE OBJECT of the following pages is to lay before English antiquaries a summary of what has hitherto been discovered respecting the lake dwellings of Switzerland, and the neighbouring countries, together with a glance at the corresponding settlements in other parts of Europe.

These facts were originally published in the reports on the subject laid before the Antiquarian Association of Zürich; but as these communications were made at various times just as the discoveries were unfolded in this new field of enquiry, it necessarily follows that the original reports contain a certain amount of repetition; and also that conjectures made at an early period of the investigation were either confirmed or disproved by subsequent discoveries. The present volume, therefore, is not a simple translation of the reports on the lake dwellings printed by the Antiquarian Association, but a condensed account taken from the whole of them: the substance remains, though the mode of stating it is altered. It may however, be well to mention, that in every case when it was possible the original has been very closely adhered to, though not the order in which it is given; and in most cases the language and expressions are the same, translated into English. To the substance of these reports a few facts have been added, lately discovered, so as to bring the information as far as possible down to the present day.

It is hardly necessary here to state, what in the year 1855 was new to antiquaries, that from a series of discoveries the fact is made manifest, that in the very earliest times groups of families, or probably whole tribes, subsisting by hunting

and fishing, with some knowledge of agriculture, lived on the borders of the Swiss lakes, in huts built not on dry ground, but on a series of piles in the shallows near the shores. Since that time it has been ascertained that this peculiar mode of living was not confined to the inhabitants of Switzerland alone, but extended to several of the neighbouring countries,—nay more than this, the information which is rapidly accumulating on all sides will probably bear out the supposition made in the year 1855, that this mode of settlement is to be found in the whole circle of the countries formerly Celtic.* At all events, lake dwellings, if not pile dwellings, existed in Ireland and Scotland, which in many respects may be considered analogous to a few of peculiar construction found in Switzerland. These peculiar lake dwellings, as well as the Irish crannoges, will be described in their place.

* The author, in his later reports; has evidently avoided using any names which might positively indicate the nationality of the lake dwellers.—[Tr.]

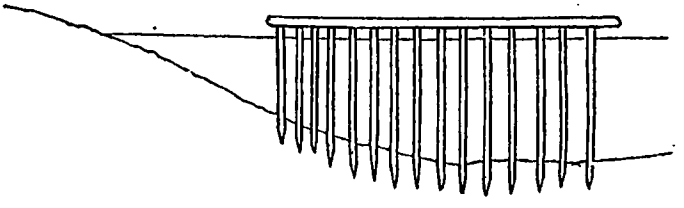
GENERAL FORM.

Before proceeding to a description of the different lake dwellings, and of the objects found in them, it may be well in the first place to give an idea of the general form of these singular settlements, and of the different varieties under which they may be classed. The substructure will naturally claim our first attention.

I. SUBSTRUCTURE.

I. PILE DWELLINGS.—What may especially be called the pile dwellings are by far the most numerous in the lakes of Switzerland and upper Italy. The annexed woodcut will give

FIG. 1.



a general notion of the arrangement: piles of various kinds of wood, sometimes split, but in general mere stems with the bark on, sharpened sometimes by fire, sometimes by stone hatchets or celts, and in later times by tools of bronze and probably of iron, were driven into the shallows of the lakes provided they were not rocky, at various distances from the shore. These piles were placed sometimes close together, sometimes in pairs, sometimes tolerably wide apart—generally in regular order, but occasionally in apparent confusion. In all cases the heads of the piles were brought to a level, and then the platform beams were laid upon them, which in some cases were fastened by wooden pins, in others mortises or central hollows were cut in the heads of the vertical piles to receive the cross beams. Occasionally cross timbers were joined to the upright piles below the platform to support and steady the structure, either forced in as it were between them or fastened to them by what

workmen call 'notching,' that is, portions were cut out of the vertical piles to receive the cross timbers. The platform lying on the top of this series of piles appears in many cases to have been of the rudest construction, and to have consisted merely of one or two layers of unbarked stems lying parallel one to another; in a few cases, as in one of the Italian lake dwellings, they were more artificial, and were composed of boards, split out of the trunks of trees, and joined with some approach to accuracy.

In many cases the outer row of piles appears to have been covered or closed in by a kind of wattle or hurdle work, made of small twigs or branches, probably to lessen the splash of the water, or to prevent the piles from being injured by floating wood.

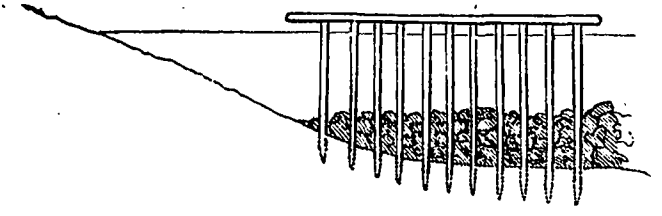
The distance from the shore as before mentioned varied considerably: there appears to have been no regular rule in this respect; it may, however, be well to mention that when a lake dwelling has been inhabited both in the stone and the bronze age, that part evidently used in the bronze age is frequently further from shore and deeper in the lake than that which belongs to the age of stone. With this exception, as far as can be ascertained, nearly the same mode of construction prevailed in the pile dwellings during the ages of stone, bronze, and iron.

Some few of these dwellings appear to have almost touched the shore, but this is not a common case: most of them, as before mentioned, are at some little distance from it, and in all probability they were connected with it by a narrow platform or bridge formed also on piles; in some lake dwellings the remains of these bridge-like entrances have actually been discovered.

In certain cases, as near Nidau &c., these pile dwellings have another peculiarity: they are formed on artificial rises in the bottom of the lake, made by a large number of stones, which have evidently been brought in boats, and sunk on the spot for some especial purpose; in fact, one boat or canoe, still loaded with the stones which proved too great a cargo for it, and which consequently sunk it to the bottom, is still to be seen at Peters Island in the lake of Bienne; the particulars will be given when this locality is described. These artificial rises, or hillocks, under the surface of the water are not uncommon, especially in the western lakes, and all go by the name of Stein-berg. The annexed woodcut gives some idea of this variety of pile dwelling.

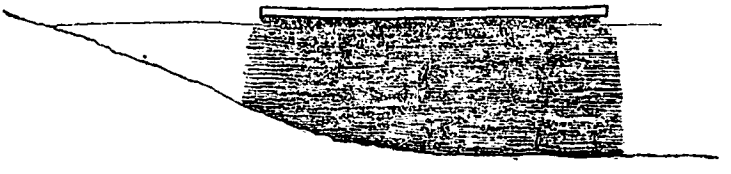
As it seems impossible, according to the opinions of the best engineers to drive piles into a regular heap of stones, we are obliged to come to the conclusion that the piles must first have been driven more or less deeply into the mud, and that the stones were afterwards thrown down between and around the piles, in order to consolidate the erection.*

Fig. 2.



II. Fascine Dwellings.—Some lake dwellings were of very peculiar structure, and may be designated fascine dwellings. Instead of a platform, supported on a series of piles, these erections consisted of layers of sticks, or small stems of trees built up from the bottom of the lake, till the structure reached above the water mark; and on this series of layers the main platform for the huts was placed. Numerous upright piles are indeed found in dwellings of this description, but they were not used to support the platform as in the pile dwellings just

Fig. 3.



mentioned, but chiefly as stays or guides for the great mass of sticks, in successive layers, which reached down to the bottom of the lake. The woodcut annexed shows a section of a lake dwelling built on this peculiar plan. As several settlements of

* An engineering friend informs me that an arrangement of a similar kind has been used on a much larger scale in the new pier at Portland. Here long piles are driven and screwed down into the tenacious clay, orming the bottom, till they are sufficiently strong to bear a kind of railroad. Huge masses of rock are then brought upon it in trams from Portland Isle, and thrown down between and around the piles, so as to form a regular breakwater against the heavy seas which beat on that coast. I am also informed by the engineer of the harbour of refuge at Holyhead, that precisely the same plan is adopted there with their long piles, except that they are not screwed but driven in to support the stage from which the stone is thrown.—[Tr.]

this kind will be carefully described in the course of the following pages, it will be unnecessary at present to enter into further detail. It may however be well to mention that fascine dwellings occur chiefly in the smaller lakes, and apparently belong to the stone age.

III. Crannoges, or 'Wooden Islands.'—These singular structures bear a great resemblance to the class last described. They have hitherto been found chiefly if not entirely in Ireland and Scotland. They were first brought into notice by Sir W. R. Wilde in the Proceedings of the Royal Irish Academy for 1840, and several were subsequently described by Mr. Shirley and other individuals. Sir W. R. Wilde's 'Catalogue' contains notices of several crannoges. They have also been found in some of the Scotch lakes, especially in Dowalton Loch, which was drained by Sir Wm. Maxwell of Monreith. Several crannoges then discovered have been described by Lord Lovaine and Mr. John Stuart. As it is intended in the course of the following pages to give a notice of the structures of this kind found in Ireland and Scotland, it will be sufficient at present merely to state that the crannoges at least in Ireland were frequently but not exclusively placed on natural islands, or on shallows which approached to this character; sometimes they were built up from the bottom of the lake on the soft mud, exactly in the manner of the fascine dwellings of Switzerland. They are surrounded by a stockade of piles, driven into the bed of the lake, so as to enclose either a circle or an oval; the diameter varies from 60 to 130 feet. These piles are usually in a single row, but sometimes the rows are double and even treble. Occasionally the piles are boards, not round stems. The lowest bed within this enclosure is commonly a mass of ferns, branches, and other vegetable matter, generally covered over with a layer of round logs, cut into lengths of from four to six feet, over which is usually found a quantity of clay, gravel, and stones. It will be seen from this short statement that the crannoges have a great analogy with the fascine dwellings of Switzerland, and this will probably appear still more clearly when the details are given hereafter. This similarity is very striking, when we consider that the Swiss dwellings were evidently places of permanent habitation—that families and perhaps tribes lived on them; while the crannoges as mentioned by Mr. Stuart are chiefly to be regarded as chieftains' forts, and fastnesses for occasional retreat. Unlike the fascine dwellings of Switzerland, which belong chiefly if not exclusively

to the age of stone, the crannoges, whatever may be the age of their foundation, continued down to the age of iron—nay, they were actually used at a very late period; whereas the lake dwellings of Switzerland, as far as we at present know, disappeared about the first century. The annexed woodcut will

Fig. 4.

probably give some idea of the appearance of these crannoges; but it is difficult to represent a structure of this kind merely in section, which necessarily is the case with the vignette, and the reader therefore is referred for more particulars to the detailed description.

II. SUPERSTRUCTURE.

Under this head there is naturally very little to say: in fact, a few words will suffice for all that we have to communicate. Except under very peculiar circumstances, timber and vegetable material cannot possibly exist long when exposed to the summer sun and the winter's storms. Still there are indications, though slight ones, as to the construction of the huts, and these will now be stated as briefly as possible.

It has been already mentioned that the main platform consisted either of round timber, or (in some few cases) of split boards. Upon this it appears that a bed of mud loam and gravel was laid, and beaten down firmly, either by the feet, or by the wooden mallets, of which several have been found in these localities. Occasionally a layer of larger pebbles is found, as in some of the Italian dwellings, near the top, probably to strengthen this kind of plaster floor.

There can be no doubt that small piles or stakes formed the framework of the huts. Some of these have been actually found projecting considerably above the platform. Probably in some cases, especially in the fascine erections, fresh piles were driven in for this purpose, which did not go quite down to the bottom of the lake; but in the regular pile buildings, they would only be piles of an extra length.

Of course these piles would mark out the extent of the

dwellings themselves, and in one or two favourable instances we have thus the ground plan of a settlement; but we have more than this: the size of the house is further marked out by boards, forced in firmly between the piles, and resting edgeways on the platform, thus forming what at the present day we should call the skirting boards of the huts or rooms. It cannot now be determined whether this was continued higher than a single board, as more than this has not as yet been actually discovered; but the advantage of even a single plank, set on edge, to keep out wet, and wind and vermin, must be generally evident. It is also perfectly certain that the walls or sides were in a great measure made of a wattle or hurdle-work of small branches, woven in between the upright piles, and covered with a considerable thickness of loam or clay; this is proved by numbers of pieces of clay half burnt, or hardened in the fire, with the impressions of the wattle-work still remaining. These singularly illustrative specimens are found in nearly every settlement which has been destroyed by fire.

All the evidence which has yet come before us, proves that the huts were rectangular; but some of them may possibly have been round, as, from ancient authors, it is very evident that the huts of many nations on terra firma were round in form.

It is not known whether the huts were divided into several rooms or not; possibly further discoveries may decide this. From the remains of straw and reeds found in every lake dwelling, it seems almost certain that the huts were thatched with these materials, and highly probable that the dormitories were strewed with the softer kinds of straw or hay.

Every hut had its hearth, consisting of three or four large slabs of stone; and it is probable from the almost universal prevalence of clay weights for weaving, that most, if not all, of them were furnished with a loom. Portions of young trees with the branches partially lopped off are also not uncommon in these dwellings; these would be very convenient, if fastened to the roof or the walls, for the suspension of the mats, the tools, the nets, or the earthenware vessels, some of which seem to have been used with rope handles.

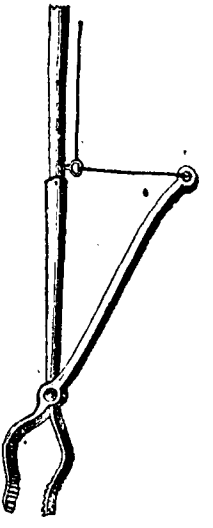
Such is the whole which we actually know, or have a reasonable probability for believing, as to the huts themselves; and beyond this it is not the province of the sober antiquary to enquire.

METHODS EMPLOYED IN COLLECTING THE LAKE-DWELLING ANTIQUITIES.*

Probably this may be a suitable place for mentioning the mode in which lake-dwelling antiquities are collected. Some lakes have of late years been either wholly or partially drained, especially those where peat has grown. In these cases the level of the water having altered, the search for antiquities has to be carried on by actual excavation either in the peat or in the ancient bed of the lake. In some cases, however, as at Robenhausen, the peat can only be excavated to the proper depth by keeping pumps almost constantly at work.

Under ordinary circumstances, however, the case is different, and the antiquities have to be looked for in the lake itself, occasionally at considerable depths, either lying on the surface of the lake-bed, or buried to some extent in the mud. In localities where the former case occurs, and where, strange to say, these primæval antiquities appear still on the surface of the lake bottom after having been exposed for thousands of years to the gaze of every boatman who passed over them, all that is required is a keen eye, clear still water, and a pair of forceps similar to those represented in the annexed woodcut. This simple instrument is fixed to the end of a long pole, and as will be seen from the sketch opens and shuts by means of a cord.

FIG. 5.

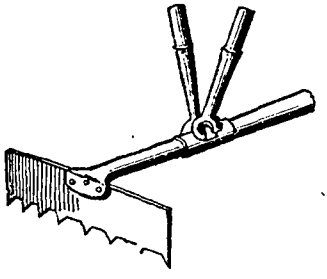


But, where the antiquities are buried in the mud, the labour is much greater; in this case a kind of implement similar to that drawn in the annexed woodcut, is used for trenching the bottom. The scraper itself is fixed to a strong pole, and is pressed down into the mud by means of two wooden handles attached to it by sockets and rings; these handles are worked from the boat above. This arrangement makes the scraper more effective, so that trenches can be dug, or rather scraped, of a considerable depth, and a large quantity of mud can be col-

* This notice does not stand in any of the original reports to the Zürich Association, but it seems so essential that English antiquaries should know the methods employed by their Swiss friends, that it has been inserted in the text together with the illustrative woodcuts.—[TR.]

lected together, which is then brought up by the usual implements and examined. It is obvious that this operation must be very difficult where the ground is encumbered by stumps of piles or stones; and it is but due to the Swiss antiquaries to mention the difficulties with which they have to contend in pursuing their investigations.

Fig. 6.



Where railway or other works are in progress a steam mud-engine sometimes brings to the view of the antiquary a great quantity of mud from the bed of the lake; but the advantage thus gained is almost more than compensated by the fractured condition in which many of the antiquities are brought up.

ORIGINAL DISCOVERY OF THE LAKE DWELLINGS.

Though the settlement or lake dwelling of Ober Meilen will hereafter be fully described, yet it may be well here to give a short account of its original discovery, as it was the first of these singular localities which was at all carefully examined, and of which the antiquities were preserved; and from its discovery we may date the long series of investigations which have yielded such a happy result to the labours of the antiquary.

It appears that so early as the year 1829 an excavation was made on the shore, in front of this place, for the sake of deepening the harbour, and piles and other antiquities were discovered. Unfortunately these facts do not seem at the time to have come to the knowledge of any antiquary; at all events, the matter was not then followed up, and we possess no precise information respecting this excavation; the earth dug out was put into boats with all that it contained, and then taken away and sunk in the deepest parts of the lake. Thus the matter rested for some years.

In the winter of the years 1853 and 1854, the extraordinary drought and long continued cold occasioned a very unusual phenomenon in the Alpine districts—the rivers shrank to their smallest compass, and the level of the lakes was lower than had ever been known before. On the stone of Stäfa the water-mark

of 1674 had always been considered the lowest known in history, but in 1853-4 the water was one foot below this mark. The low shelving shores became dry land, and islands appeared never before noticed. These circumstances, though unfavourable for millers and watermen, were very advantageous for the erection of buildings by the water's side; and they were especially welcome to the archæologist, as many interesting localities were thus brought to light, which for centuries had been withdrawn from view, and doubtless will not for a length of time, be accessible to future generations. While remains of Roman construction came to light on the banks of the Rhine, the Aar, and the Limmat, antiquaries were able for the first time carefully to examine the settlement of hoary antiquity above mentioned in the lake of Zürich.

In January 1854, Mr. Aeppli of Ober Meilen informed the society at Zürich, that remains of human industry, likely to throw unexpected light on the primæval history of the inhabitants of the country, had been found near his house in that part of the bed of the lake then left dry by the water.

The discovery of these antiquities was made in the following manner:—The inhabitants were making use of the low state of the water to recover from the lake a certain portion of land, which they had enclosed with walls, and were filling in the space with mud, excavated from the shore a little in front. This was done at two places in the little bay between Ober Meilen, and Dollikon. The workmen, as soon as they begun to excavate, found to their great astonishment the heads of piles, and a great number of stags' horns, together with several implements, an account of which will be given in the detailed description of this settlement. It will be sufficient at present merely to refer to the plan drawn (Plate I., fig. 1), made by Mr. Aeppli, which shews the localities of the different excavations. As this was the first lake dwelling which came to light, it seemed desirable, before entering on the general subject, to give the particulars of a discovery which was so quickly followed by others, and has led to results of such extraordinary interest.

In this plan A shows the place where an excavation took place in 1829 and piles and antiquities were discovered. B the land recovered by Mr. Glogg in 1851, when piles and implements also were found. C the embankment of Mr. Grob in 1854, and DD the places which supplied the material for filling in. E the embankment of Mr. Rhyner also in 1854, and FF the places from

which the mud was dug out. The extent of the piles and consequently of the settlement is marked by the space covered with upright dotted lines.

REMARKS ON THE AGES OF STONE, BRONZE, AND IRON.

It is well known that many antiquaries divide bygone ages into the stone, the bronze, and the iron periods; and attribute any burials or settlements to one of these divisions, according to the exclusive or prevailing presence of implements of any one of the three materials which are the groundwork of this classification. This division, according to the grade of civilisation, is in general clear and convenient; but in determining isolated cases it leads to many false conclusions and errors. In the first place, it has throughout only a relative value: for instance, if we grant that the civilisation of man actually ran its course through these periods, just as they are mentioned above, yet it is certain that the bronze period of northern Europe by no means agrees in time with that of the middle and southern parts of this continent. Again, the bronze age of Greece and Italy may be separated by centuries from that of Egypt, which we may consider as the cradle of civilisation. We may safely conclude, as the Danish antiquaries themselves allow, that in the Scandinavian countries, stone implements were for a length of time continued in use while the bronze period was in full activity in the more southern lands, and that Egypt, whose oldest monuments indicate very clearly the use of iron, and also Greece, had both advanced to the iron period when middle Europe was in the bronze age. If therefore, according to the testimony of ancient authors and monuments, bronze and iron were used in the earliest ages in the countries round the Mediterranean, the commencement of these periods in the inland and northern parts of Europe was regulated entirely by the greater or less amount of intercourse between these countries, and those to whom we are indebted for a knowledge of these materials, so essential to civilisation. We may even at the present day observe a similar irregularity in the distribution of the products of higher civilisation and art. In the second place, this kind of division gives us no positive certainty; for in very few of the burial places, still less in the regular settlements, are the remains found so purely distinctive as to enable us conclusively to attribute them to any one of the three periods. The mate-

rials on which this division is based are mixed to such a degree, that in nine cases out of ten the antiquary remains undecided as to what period of civilisation he should assign a grave or a settlement. An object very commonly both in form and material bears the character of different periods; or it may be a specimen useless in deciding the age, being found in settlements of all the three periods. Thus the stone celt is an unsafe guide in determining the period of civilisation, though it strictly represents the stone period, because it occurs in all stages of the bronze age, and is not unfrequently found associated with iron weapons and instruments.*

It is very certain that, at least in Switzerland, there was no hard line of demarcation between the three periods, but that the new materials were spread abroad like any other article of trade, and that the more useful tools gradually superseded those of less value.

Though it has been thought necessary to give these words of caution as to the use of the three periods in a very definite and rigid manner, yet, rightly understood, the division is very convenient, and it will be adopted to a certain extent in the following detailed accounts of the various lake dwellings hitherto discovered. Of some of these settlements we know a great deal, of others but little, and of very many we have only indications. Probably the best plan will be, first, to describe the settlements most known, or most typical of the stone, the bronze, and the iron ages; and then it may be advisable to give a geographical list of the whole of the lake dwellings hitherto discovered, including those of which all that we know is their existence.

* Kirchner has given many cases of this kind, 'Thor's Donnerkeil,' p. 25.

MEILEN.

This well-known locality, the first discovered of all the lake dwellings, has been in some measure described in the chapter giving the original discovery of these singular structures; at present, therefore, it only remains to complete the description of the place, and to give an account of the objects which have been found there. It is a settlement of peculiar interest, not merely because it was the one first known, but also because it belongs almost exclusively to the stone age. The only objects of metal which have come to light are a single bronze armilla (Plate III. fig. 12), found in the course of the early embankment, and one bronze celt, discovered in a late excavation by Colonel Schwab of Bienne (Plate III. fig. 26). With these two exceptions, all the antiquities consist of stone, bone, horn, wood, or earthenware.

According to Professor Linth Escher, the following is the geognostic sequence of the beds:—'In the places excavated the upper bed, from one to two feet thick, consisted of yellowish mud, such as we see everywhere accumulated in the shallow indentations of the lake when not much exposed to the action of the waves. The numerous rounded pebbles found in it had doubtless been brought down during floods by a small brook, which empties itself into the lake. In this bed the workmen observed no traces either of piles or of animal remains.

The second bed, from 2 feet to 2½ feet thick, consisted also of sandy loam, but from the decay of a great quantity of organic matter in it, it was coloured black. It was in this bed, which for the sake of convenience we will call the 'Relic-bed' (Cultur-schicht),* that the heads of piles were found, as well as the antiquities which are about to be described. See Plate I. fig. 2.

* It is somewhat difficult to translate this word 'Cultur-schicht.' The nearest English words for 'Cultur' are Civilisation, and Culture; but in neither case is the full meaning of the German word expressed. Culture in English, even in a figurative sense, can hardly be said to apply to matters of handicraft, being used chiefly with reference to the mind; Civilisation, again, seems to apply chiefly to the manners. The

The third bed, which probably is of considerable depth, consisted, like the first, of clear mud or loam, such as that found everywhere at the bottom of the lake. It contained the lower part of the piles, but no traces of human art or of animal remains.'

The question how far the relic-bed, or in other words the settlement, extended cannot be answered with certainty. The inhabitants of Ober Meilen assure us that no piles are to be found in the immediate neighbourhood of the bank. The rows of piles begin several fathoms from the shore, and continue till the lake suddenly becomes deep. The limit of the piles on either side is uncertain, but it is probable that they do not reach far beyond the extreme point of the bay. It is a singular fact that the remains of human art are much more numerous on the side next the lake, so that the chief places of abode must have been situated not on that side of the piled space nearest to the land, but towards the opposite margin.

The piles consist of oak, beech, birch, and fir, and are from four to six inches thick. Some few of them are whole trunks, but these may be considered as exceptions; the majority, as may be plainly seen from the rings of growth, consist of stems, split into three or four parts. All the piles discovered in the first excavation were more or less charred, and had been sharpened at the lower end either by means of fire, or by the stone celt; it was plain that fire had been used for that purpose, to save the great labour caused by such inefficient tools. It is singular that somewhat different results were brought to light by the excavation made by Colonel Schwab, which shall now be mentioned.

The low level of the water in February 1858, induced this gentleman to make a fresh investigation of the place, especially as that of 1855 was by no means undertaken with a view to archæology. Under his direction the ground was excavated on the strand, then laid dry, first between the letters FF (see the Plan, Plate I. fig 1), and then, after the erection of a cofferdam, to the right of the letters DD. The objects found consisted of stone, bone, and horn implements, similar to those previously

German word 'Cultur' seems to refer to mind, manners, and art of every kind, including handicraft skill. Besides this, the term 'Civilisation bed' is one which could not be used, and 'Culture bed' sounds nearly equally harsh. Some French writers translate the word 'Couche Archéologique,' which does not seem quite satisfactory. I had at first translated it 'Implement bed,' though with some misgivings; but when a well known antiquarian friend, the Rev. C. W. King, suggested the term 'Relic bed,' all difficulty vanished: it is not a literal translation, but it seems to come as near as possible to the implied meaning of the German word.—[TR.]

found. Amongst rather a large number of stone celts there are several of clear nephrite, which appears to be found more plentifully here than elsewhere; and, what is very singular, one well preserved bronze celt as before mentioned (Plate III. fig. 26), thus showing that the existence of this settlement had reached the bronze age. Besides this, there was another singular fact; near the second of the places above mentioned, where the piles had been sharpened by fire, others were found which had been brought to a point by a sharply ground bronze celt or hatchet, thus proving as it were the genuineness of the bronze celt. Bones were found in great numbers, amongst them those of the stag, roe, wild goat, wild boar, and fox, besides those of domestic animals, such as the cow, the sheep, and the dog. Some human remains were also found here.

The original length of the piles cannot now be determined, as they only reach up into the relic-bed, and the actual summits, which were doubtless above the water level, have long since disappeared; they must, however, have varied very much in length, for some, which were completely dug out, measured seven or eight feet, while the ends of others were not reached by digging nine or ten feet under the relic-bed. Nearly all of them were so soft and rotten that they were no hindrance to the workmen's spades, and were as easily cut through as the silt itself. It was almost impossible in the hollows filled with mud, where the labourers had to work, to mark out the arrangement of the piles, and to measure with any accuracy the distance between them; but according to the report of all the workmen, the rows of piles run parallel with the shore, and in tolerably straight lines, forming also other lines nearly straight at right angles. In some places they stand closer together than in others, but on the average they are about a foot or a foot and a-half apart. Their arrangement is shown in Plate I. fig. 3. Between the vertical piles a few beams were met with, lying horizontally, stuck in the mud, and which apparently had been part of the scaffolding or platform resting on the piles. As we shall hereafter have to treat of the use of these piles, we will now proceed to the description of the objects found here.

OBJECTS IN STONE.

Stone Celts and Stone Chisels.—These tools, which are the most abundant of all early stone implements, and are spread over France, Germany, England, Scandinavia,* and doubtless every European† country, form the most important portion of the antiquities discovered at Meilen. They are remarkable, not merely for their number, but for their variety, both in form and material. As no notice was taken of them till after Mr. Aeppli's suggestion, and the workmen say that a very large proportion were either not preserved at all, or were afterwards thrown aside as useless, it may easily be imagined that several hundred specimens were buried in the few square fathoms of ground excavated. About a hundred of these implements, some in good preservation, others somewhat damaged, have come into the hands of the Zürich Antiquarian Association.

The usual form of these implements, or stone celts, as they are called, is that of a wedge. If the cutting edge spreads out or is broader, they resemble hatchets; but if they are of uniform breadth or bulge in the middle, not an uncommon case, then they take the form of chisels. The section of many specimens about the middle is square with sharp corners; others are roundish or oval in section, and consequently approach the form of a cylinder. There are examples where one side of the cutting edge is concave and the other convex, so as to have the appearance of gouges, and very probably they have been used as such. In many specimens, the sloping sides show the natural roughness of the stone, while others have them ground or smoothed; but a great number, after having been polished on these parts, have again been intentionally made rough or grained.

In size these instruments vary exceedingly, so much so that while some are eight inches long, the smallest is only one inch in length, and while the weight of the largest is a pound and a

* Stone implements have been found of all shapes in Denmark; they are described in 'The Primeval Antiquities of Denmark by Worsaae, translated by William Thoms.' London, 1849. And in the 'Nordisk Tidsskrift for Oldkyndighed udgivet af det kongelige nordiske Oldskrift-Selskab. Forste Binds andet Häfte.' Copenhagen, 1833.

† It is mentioned by the Livingstones in their 'Narrative of an Expedition to the Zambesi,' as a remarkable fact, that while in many parts of the world the stone, bronze, and iron instruments of men who have passed away have been found, no flint arrow heads, spears, axes, or other implements of this kind, so far as we can ascertain, have ever been discovered in Africa.—[Tr.]

half, that of the smallest, of the same kind of stone, is only about a quarter of an ounce. (See Plate II. figs. 12 and 13, where the figures are drawn of the actual size.)

With respect to the material, these implements consist partly of native, and partly of foreign stone, at least of such kinds as have not yet been found 'in situ' in Switzerland; and in some cases even of stone, the existence of which in any part of Europe has not as yet been ascertained.

Many celts consist of diallage, gabro, and hornblende rocks, none of which are found in the gravel of our neighbourhood, nor have they, generally speaking, as far as is known, been discovered in the Alpine districts. The material is not very accurately designated by these names, for in fact it is a variety between the rocks just named and the talco-silicates.

Other specimens consist of syenite, like that which is found 'in situ' in the valley of the 'Vorder-Rhein,' and is also frequently found in the gravel of the valleys of the Rhine, the Limmat and the Glatt. In one single case the stone is very like the fine-grained black sandstone of the nummulite formation of the high Alps of Glarus, such as is seen at the Hausstock and the Panixer Pass. Those made out of nephrite or jade probably derived their origin not from Europe, but from the East. We may have more to say on this point hereafter.*

Several specimens show incisions and other marks of working which reveal to us the mode in which the celts were manufactured. Stone of a tough nature was chosen for this purpose, and then incisions were made in the flat surface by means of a sharp saw-like tool, sometimes on one side and sometimes on both; the stone was then broken in two, just as slabs of slate are brought to the proper form for writing and roofing slates. Other specimens made of stone which was not at all slaty, were first hammered into form, and then ground, a work which must have been attended with much labour. All the celts seem at first to have had a very sharp cutting edge; we have several specimens which might readily be used for cutting lead pencils.

* Montfaucon Antiq., exp. vol. v. p. ii. p. 194.—In the year 1685, an axe made of eastern stone called jade, a kind of lapis nephriticus, was found by M. Cockerell in a tumulus in the diocese of Evereux (Normandy).

Celts made of a kind of nephrite are to be seen in the Royal Museum of Antiquities in the Castle of Monbijou at Berlin, and also in many of the museums of Germany, France and England.

In vol. lxi. of the Tr. of the Imp. Inst. of France M. Damour has published an interesting paper on the so-called nephrites in the Celtic tumuli: he does not consider the stone to be true nephrite. He thinks that several of the celts from Meilen are diorite.

With respect to the place where these stone celts and chisels were manufactured, there can be no doubt at least with reference to a considerable number of them, for several specimens were found at Meilen, which had been partially worked, but were not completed; that is, they were in process of manufacture. Besides this, a number of fragments were found, which are easily recognised as the refuse from chipping or sawing the material into form. Lastly, we have a number of stone slabs which have served for grinding these implements. These slabs are of sandstone from the quarries of Bollingen, on the upper part of the lake of Zurich, which have been much used from the time of the Romans. Deep furrows and grooves are found upon them, caused by the backwards and forwards motion of the celt which had to be ground or sharpened upon them. Other slabs of somewhat harder stone, but brought from the same place, had a surface as smooth as a looking-glass—a proof that they were used for polishing off the celts. From all this we may with safety conclude, that the celts of native stone were made and completed by the manual dexterity of the inhabitants of the lake dwellings of Meilen; but it must be left undecided whether the celts of foreign material were brought here already made, or in the shape of raw material.

The mode of hafting these tools is very interesting. All the celts and chisels found at Meilen originally were hafted in pieces of stags' horn, and a considerable number were found still in their handles. To make this hafting, a piece of the requisite length and thickness was cut out of the main stock of the stag's horn, clearly with no other instrument than a stone celt. A hole was then worked out at one end, wide and deep enough to receive the lower part of the celt. The other end was cut into a four-sided tenon or plug, evidently intended to be set in a shaft, a stick, or a club. (Plate II. fig. 2.) Of this third limb of the implement not a single perfect specimen was found here, for every thing of wood which was not sunk like the piles in the mud, had lost all consistency, and although the fear of the thaw setting in prevented any investigations which took up time, yet some slight remains of wooden shafts of this kind give us a clear insight into their general form. The perfect implement complete with all its three parts, has been found at Robenhausen. (Plate X. fig. 7.)*

* Pieces of stags' horn with stone celts fixed in them, such as those drawn (Plate II. fig. 4), but bored through in the middle so as to receive a handle, are to be seen in the museum of Amiens. In the year 1842 a stone celt fastened in this manner was found

Another form somewhat different from that last described is given. (Plate II. fig. 4.) Stones were frequently found put into longer pieces of horn so as evidently to be used as chisels. In one long piece of horn, each end had a chisel of nephrite fixed in it. (Plate II. fig. 3.)

With respect to the use which was made of these stone celts or hatchets, there has been a great discussion for more than a century, both as to them and to their allied forms in bronze. Some antiquaries consider them as weapons of war, others as household implements, others again as instruments of sacrifice, and some as symbols. The stone celts found at Meilen appear to throw considerable light on this very debatable question. In the first place, we must express a decided opinion against the idea which has lately reappeared that these stone celts were used for religious purposes alone, and that they were not employed either in the house or workshop.* For, amongst the celts found at Meilen, by far the greater number are more or less damaged by notches and fractures on the cutting edges. Many specimens had been cracked, either lengthwise or across, and had been thrown aside as useless; and even in many perfect celts, it may be seen that the edges which had been spoiled had been repaired and ground: in fact, some had evidently been quite worn away by repeated grinding. The value which was especially set upon celts made of nephrite is shown by the fact, that when a part of the edge was cracked off, the rest of the celt, even when the edge was only a few lines broad, was again carefully ground; nay, even hatchets which had the whole cutting edge broken were reversed, and an edge made at the opposite end—so carefully was every fragment of a good stone brought into use.

It has been already remarked, that in the first excavation all the piles found were made sharp, to lessen the labour of driving them in, either by means of fire, or by the stone celt or axe. Five of the piles in the best state of preservation, consisting of fir wood, were examined by carpenters and joiners, and their unanimous opinion was, that from the nature of the strokes the

in a grave near the little town of Crécy not far from Meaux, 'Investigateur,' 1854, janvier. 'On y a recueilli des coins en silex et en serpentine, des amulettes en serpentine et une espèce de poinçon très-effilé, formé d'un morceau de tibia de chèvre ou de chevreuil, mais on y a trouvé un objet qui offrait un caractère particulier d'intérêt; c'est une hache formée d'un beau coin en jade, parfaitement aiguisé, ajusté dans un gros morceau de corne de cerf, dans lequel est pratiquée une mortaise destinée à recevoir un manche.'

* Kirchner, Thor's Donnerkeil, Neu-Strelitz, 1853.

hewing, or rather the hacking of the points indicated very clearly the use of the stone hatchet, and that no tool of any kind of metal, nor any usual instrument of carpentry had been employed about the work. In order to test the possibility of working timber with such tools, and to prevent any doubt which might arise, we had several trials made with these stone implements, and they have perfectly convinced us of the correctness of the conclusions arrived at. It must however be remarked, that the trials were made with green wood, and that very probably the builders of these lake dwellings did not use dry timber, but fresh wood, just as it was brought from the forest. If we also examine the handles and other implements of stags' horns with the view of ascertaining how they were worked, we shall come to the conclusion, notwithstanding the fact of one or two bronze implements having been found here, that with the exception of the few piles found in Colonel Schwab's second excavation, not a single specimen shows the work of any metal tool, but that they have been brought into their present form by stone implements alone. The horns had evidently been worked when fresh, or after having been softened by steeping in water.

The choice of the kind of stone was made according to the practical use for which the tools were intended: thus every material worked into celts possessed in the highest degree the qualities of toughness and strength. A harder, but more brittle substance, even if very conspicuous by its colour, was disregarded at least in our district where so many different kinds of stone are to be met with. No celts, consequently, are to be found in our museums made of granite or any kind of limestone.

With respect to the use made in general of these stone celts, we can hardly be wrong in concluding that they answered the most varied requirements according to their size and form, the nature of the material, and the mode in which they were hafted. It is possible that the stone celt fixed in the end of a pole may have served as a lance point;* if set in a club, either with or without a horn hafting, it would be equally useful as a weapon of war, or an axe for household purposes. Either fastened in a longer piece of horn, or without any handle at all, it stood in the place of the poor man's knife for all kinds of handicraft work, and formed the chief implement of the household, which as yet was but scantily furnished with tools. It doubtless, in short,

* 'Jactant Angli cuspides ac diversorum generum tela, sævissimas quoque secures et *lignis imposita saxa.*' William of Poictiers in the History of William the Conqueror (see Caumont, Cours d'Antiquités, vol. i. p. 221).

fulfilled all the requirements which antiquaries attribute to it, and served for skinning animals, for cutting the flesh in pieces, for cutting and manufacturing the hides, for preparing clothes, and all the different implements whether of horn or wood. In short, it was probably applied to many more purposes than we can imagine, unacquainted as we are with the habits of life of those who used it.

It may not be amiss here to mention, that the inhabitants of New Zealand, who thoroughly understood working nephrite into axes and chisels, use for coarser work, such as felling trees, and house and boat building, tools of the weight of six or eight pounds, while those used for carving in wood only weigh as many ounces. They have, however, to be sharpened nearly every moment, so that the workman always has standing by him a stone and a cocoa-nut shell full of water.* In felling timber many axes are spoiled, and yet with these very tools they work and finish off their large canoes, made out of trees 8 feet in diameter and forty feet long, and they split the trunks into planks which they work, or plane as it were so skilfully that they can take off quite thin strips without a false stroke.

In Dominica also, according to Dr. James Clarke, the Caribs are accustomed to cut down large trees with stone hatchets.*

Stone Hammers.—Three stone hammers were found at Meilen. Of these one is drawn (Plate II. fig. 9); it consists of very hard and tough stone like serpentine; one end is wedge-shaped and the other has been ground flat. In the middle or thickest part of the tool is a circular helve hole of the same width throughout, which has been brought to a fine polish; it was bored so accurately that no workman of the present day could do better. The second drawn (Plate II. fig. 6) is formed apparently for hammering only, and is a cylindrically shaped tool, in one place bored entirely through, and in another only partially so. The holes are not everywhere equally wide, and it is very evident that the tool used to bore the stone had an uncertain (or what the workmen call a 'wobbling') motion. It is remarkable, however, that in the partial boring, a projecting point has been left standing at the bottom of the hole, which undoubtedly indicates the employment of some kind of tube as the boring tool.†

* Archæol. xv. p. 408.—Klemm's Handbuch, p. 154.

† Unless we consider that this hammer was bored in the later days of the settlement when bronze had in some measure come into use, and thus imagine that a metal tube had been employed, we are almost obliged to believe that some implement of flint must have been required which was either naturally or artificially somewhat in the form of

The third hammer is of very pretty spotted serpentine, rather soft; and it has been bored first by making some kind of a hole and then widening it with an instrument which worked like a file. The face is intentionally rounded, and all the four sides are carefully polished. (Plate II. fig. 10.)

Flint Implements.—In France, Germany, and the Scandinavian countries, flint implements are met with in great numbers in the shape of knives, saws, sickles, arrow and lance heads, hammers, &c; but in Switzerland very few have been found. Ancient burials, which in the above-named countries often yield abundance of these objects, have to the best of our knowledge hardly afforded us a dozen flint implements. The reason of this is that the raw material or the nodular flint found in the beds of the chalk is not met with in Switzerland, and hence the larger flint implements which are discovered there are to be considered as imported materials. The greater part of the flint found in Switzerland, made into tools, as far as can be judged from the nature and colour of the material, has been brought from France.

a tube or cylinder. In most countries where chalk is found there are certain fossil sponges enveloped in hard black flint, but with the centre, containing the organic remains, very soft and friable; in some cases the sponge has disappeared and the flint is actually hollow. Now where the sponge is of a lengthened form, or at any rate has a slender stalk, a portion broken off would virtually for all practical purposes be a small cylinder of flint, and if fastened to a pole and made to revolve by a bow and cord would form with the addition of sand and water a very efficient tool. Sponges of this form are said not to be found in Switzerland, but they occur plentifully in France and England. It has been shown in a treatise of Gutsmuths (Morgenblatt, No. 253, 1832) entitled 'How the ancient German bored his battle axe,' that a similar plan was adopted in the bronze age, by fitting to a cylinder of metal, probably of bronze, a wooden staff which was made to revolve rapidly by a bow and cord. A friend well acquainted with the processes used in engraving 'hard stones' is of opinion that these curious cuttings may have been produced (supposing metal at that time to have been unknown) by the revolution of a *hollow* stick, a piece of elder-wood for instance turned like a drill and supplied with sharp sand and water. The circumference taking up the cutting particles would act on the stone exactly as a similar tool of soft metal, only it would require more frequent renewing. This is something more than mere theory, for La Chaux observes that Guay, to give the last finish to his elaborate cameo portrait of Louis XV., worked the diamond powder into the minuter lines of the work, not otherwise accessible, with the point of a *quill*. As for the use of a hollow cylinder in cutting large openings in gems, De Boot, writing in 1600, figures amongst other instruments of the lapidary one then generally employed, where it was advantageous to save the excised portions of the material as well as labour and emery powder; for example where a gem (carbuncle or lapis lazuli) had to be hollowed out into a cup. This instrument was a thin brass tube of considerable relative diameter; it was fixed to a stalk driven by means of a strap and wheel and acted in a vertical direction upon the material, being pressed down by a heavy weight applied above. The several '*cores*' as they were formed, were removed by means of a differently shaped tool; for in the case in question the perforation necessarily was bounded by the bottom of the intended vase.—[Tr.]

The settlement at Meilen is therefore of great interest, as it is a tolerably productive locality for flint implements, though they are remarkable neither for the variety of form, nor for beauty of workmanship.

Our collection has furnished the following specimens:—

1. A number of rather long tongue-shaped pieces, which are quite flat on one side, and on the other there is a flat plane sloping off to the edges so as to form on each side narrow flat surfaces the whole length. These implements are from five to six inches long; one end is pointed, the other is blunt. It is not easy to decide whether they were used as lance points, for which their form seems so much adapted, or for saws; their serrated edges would make them very useful tools of this description. (Plate III. fig. 2.)

2. Several flakes three inches long and one and a quarter inch broad, flat on one side and on the other having a sharp ridge shelving off to the edges on each side, and thus making two flat surfaces the whole length. Two specimens of this kind were found arranged in a very remarkable manner, which leaves no doubt whatever as to their use. One edge, in fact, is inserted in a piece of yew wood, of the form of a weaver's shuttle, as in a kind of sheath, and is fastened into it with asphalt or mineral pitch: this arrangement was first observed in this settlement. These instruments were doubtless used as small saws, and the wooden backs made them easy to hold,* and prevented the hand from being wounded when pressed sharply down. (Plate III. fig. 1.)

3. A number of arrow heads, only one of which however showed any good workmanship. (Plate III. fig. 22.)

4. Several pieces of flint, the form of which shows that they were used as knives. (Plate III. fig. 3.) The size varies from two to six inches.

5. Small flakes with very fine and uncommonly sharp edges running to a point, which were used as cutting instruments; a great many flakes had quite the appearance of refuse or chips, which must have occurred in manufacturing the flint implements.

Grinding Stones.—Slabs of sandstone have been found, which evidently, from the marks upon them, had been used for grinding and sharpening the stone celts.† One of them is drawn (Plate III.

* 'Nordisk Tidsskrift,' vol. i. part ii. fig. 22. In order to give strength to this piece of serrated flint, it was *probably* set in wood in such a way that only a small part with the teeth projected.

† Compare 'Nordisk Tidsskrift', vol. i. part ii. and 'Urda, a norsk antiquarisk-historisk Tidsskrift, vol. i. part i. where a similar implement is described.

fig. 23). Several prismatic pieces of sandstone such as that drawn (Plate III. fig 5) have also served for grinding and whetting.

Awls or Piercers.—Under this class of instruments we may place two small oblong plates, one made of a green kind of nephrite (Beilstein), nearly five inches long, and six lines broad, the other of the red slate of the district, as broad as the first, but much shorter. Both plates are perforated at one end, and by constant use have been brought to a smooth surface. (Plate III. fig. 4.)

Corncrushers and Mealing Stones.—Following the example of the northern antiquaries, we class under this head certain roundish stones, the size of a man's fist, made out of very hard rolled sandstone, and with certain hollows and flattened surfaces: the whole of them have been hewn and roughened on two opposite sides by blows with a pointed instrument.* They vary in form to some extent; some are like an orange, others like a ball with depressions on the four opposite sides. (Plate II. figs. 7 and 8.) Some doubt might possibly have arisen as to the correctness of the name given above, and they might have been considered merely as a kind of hammer, had not a sandstone been found, made with a circular cavity into which these stones fitted, and thus pretty nearly proved the use above assigned to them. The 'mealing stone' drawn in the plate of objects from Nidau (Plate XXXVIII. fig. 5), was in fact from Meilen; but these objects in the two settlements are so precisely similar that one sketch will answer for both. Both stones together consequently formed a stamping and grinding machine, which was used for crushing corn before the invention of handmills. Some corncrushers consist merely of cylindrical unworked rolled stones, both ends of which were made rough. (Plate II. fig. 11.)

Since the above notice was published in the first report on lake dwellings to the Zürich Antiquarian Association, a volume has appeared, which is of great interest, as it throws much light on the manners and customs of the savage nations of Africa. The work in question is a 'Narrative of an Expedition to the Zambesi and its Tributaries, by David and Charles Livingstone, London 1865.' Amongst other things the drawings on pages 543 and 544 are very remarkable, as they represent mealing stones and corncrushers which are actually in use at the present day, and which are identical with those of the lake dwellings. The drawing of the woman at work with these implements might be given as a representation of a lake settler similarly

* 'Nordisk Tidsskrift,' vol. i. part ii.

employed. 'The mill,' say the travellers, 'consists of a block of granite, syenite, or even mica-schist, fifteen or eighteen inches square, and five or six thick, with a piece of quartz or other hard rock about the size of a half brick, one side of which has a convex surface and fits into a concave hollow in the large and stationary stone. The workwoman kneeling grasps this upper millstone with both hands, and works it backwards and forwards in the hollow of the lower millstone, in the same way that a baker works his dough when pressing it and pushing it from him. The weight of the person is brought to bear on the moveable stone, and while it is pressed and pushed forwards and backwards, one hand supplies every now and then a little grain to be thus at first bruised and then ground on the lower stone, which is placed on the slope, so that the meal when ground falls on to a skin or mat spread for the purpose. This is perhaps the most primitive form of mill, and anterior to that in oriental countries, where two women grind at one mill, and may have been that used by Sarah of old when she entertained the angels.'

Hearth Plates.—Many larger slabs have been found, made of the sandstone of the district, which have been exposed for a length of time to the fire, and burnt to a red colour; they were also partially covered with soot: they can hardly have been used for any other purpose than that we have mentioned.

Lastly, several pieces of fine carbonate of lime were brought up out of the mud with the other objects. It cannot be determined whether they were to have been crushed, and mixed in the shape of grains with the clay used for making pottery, or whether they had been brought here by the settlers as curiosities.

'*Objects made of Organic Material. Bone Implements.*—These may be classed under three divisions.

1. Small instruments ground into the shape of a chisel, which may have been used for making the earthenware vessels, and more especially the ornaments which are found upon them. (Plate III. fig. 25.)

2. Needles for knitting, and pins for the hair, or for fastening the clothes. (Plate III. figs. 17, 18.)

3. Various sizes of awls or piercers either with or without an ear. (Plate III. figs. 15, 16, 19, 20, 21.) The awls intended merely for boring were made either out of the leg bones of some small animal, in which case one end remained in its natural state and served for a handle, or out of the ribs of stags and boars; those of the latter sort would naturally be flat and

somewhat bent, and were probably used also as arrow heads, for which they were very well adapted.

Implements of Stags' Horn.—Three tools like hammers or mallets. All three were made out of the main branch of the horn; a piece was cut off from six to eight inches long, and a hole was made in it for the insertion of a handle. One of them is neatly polished, the second is remarkable for the skill shown in the helve hole (Plate II. fig. 5), and in the third the helve hole runs not straight, but obliquely, through the horn (Plate II. fig. 1). This hammer is ground and sharpened at one end, and might be used as a hatchet. The polished specimen was the only one in which any portion of the handle remained. These tools are so worn down that it is difficult to determine their actual use.

The remaining implements of horn were several awls or piercers of different sizes, and the handles of the chisels already described.

Implements of Boars' Teeth.—Useful notching or cutting instruments were very simply and easily made out of these materials. Large boars' teeth, either whole or split in two, were ground sharp at one end, so that the enamel of the tooth formed the edge of the knife. These specimens very much resemble shoemakers' knives, and doubtless were used for cutting skins and leather. About half-a-dozen specimens have been preserved; some of them were perforated at one end. (Plate III. figs. 10, 11.)*

Implements of Bears' Teeth.—Several specimens have been found of the large teeth or tusks of bears, brought to a point at the fang, and perforated near the end: they are also very finely polished. The fishermen think that these teeth were used for making fishing nets (Plate III. fig. 6). Or were they worn as ornaments or amulets? Similar objects have been found at Concise and other lake dwellings.

Animal Remains.—During the excavations the attention of the workmen was strongly excited by the great number of loose bones of wild boars and stags, particularly by the abundance and size of well preserved stags' horns and boars' tusks. Amongst a heap of things of this kind there were, as before mentioned, the horn of an ibex, and the skull of a fox, and the remains of

* Archæologia, xxx. p. 333.—In a barrow of South Dorsetshire were deposited a deer's antler, a spear head of stone, an arrow head of flint, and the tusk of a boar. A hole was nicely drilled through this tusk, and it had probably been worn suspended from the neck. Also Archæologia, xv. 122.—In a Wiltshire tumulus, several perforated boars' teeth were found.

domestic animals in abundance, such as those of the cow, the sheep, and the dog, besides a few human remains, such as the skull and portions of ribs which have been already referred to. It should be remarked also, that a considerable number of the stags' horns were cut into pieces, or the main stem has been separated from the branches by cutting instruments of stone, and that marks of this operation and incisions were to be seen on nearly every portion of bone.

Amber.—A single bead of this material was found exactly like the beads used for neck ornaments, which are met with not uncommonly in ancient graves. (Plate III. fig. 8.)

Wood.—An oak club, of which a sketch is given (Plate III. fig. 14), also a number of charred boards, originally split out of the trunk, but partially hewn or hacked with stone celts. Charcoal and half-burnt pieces of oak, beech, and firwood were found very generally, and in great abundance. A part of this burnt wood belonged undoubtedly to the dwellings themselves, which were clearly destroyed by fire; the rest probably is the refuse of the wood used on the hearths, for that the settlers had hearths in these lake dwellings is proved both by the hearthstones actually found, and also by the appearance and condition of the cooking utensils.

Metal.—The only two objects in metal found here were the armilla made out of thin bronze plate or flat wire (Plate III. fig. 12), and the bronze celt found by Colonel Schwab in his subsequent excavation (Plate III. fig. 26). No implements of iron were noticed here, at least none were preserved.

Utensils made out of Clay.—The pottery which has been found here in tolerable abundance perfectly resembles in material, shape, and mode of working, the specimens dug out of the tumuli. No whole vessels unfortunately were discovered, but some fragments were so large and well preserved that we can perfectly understand their form and mode of manufacture.* An examination of these specimens shows that there were two kinds of pottery, one extremely coarse, and the other far better in every respect. The potters' wheel was not used in any case,

* My attention has been drawn by a classical friend to a passage which bears on hand-made pottery. He says, 'In turning over Athenæus the other day I came upon a notice of *hand-made* pottery which from its late date (under Severus) may perhaps interest you. "A peculiar kind of cups are made in the native place of our fellow guest Athenæus, *Naucrates*; for they are shaped like bowls (*phialæ*), and made not on the *wheel* but as it were by the finger, and have four ears (handles) each, and the base spread out wide. The potters dip them (i.e. glaze them) so that they look as if silvered over."'—[Tr.]

but all the vessels were made by the hand alone, aided by moulding and scraping tools, and for this reason they exhibit a good many bulges and lumps, and the sides are of unequal thickness; they have also been ill burnt, and in an open fire, so that the mass did not harden properly, and does not ring when struck. By far the larger proportion are specimens of coarse workmanship, and are portions of great vessels with a wide mouth, and an average diameter of from seven to thirteen inches in the bulge, which would hold from two to seven quarts. (Plate III. figs. 7, 9, 24, 27.) They were not made of purified clay, but of common unwashed loam, in which quantities of grains of broken gravel and granite were kneaded, some of which are the size of a bean.

This mixture, according to the opinion of those who understand the art of pottery, was useful not merely for making the vessels durable, but for enabling them to resist the fire. It is very certain that they were used as pipkins over the fire, for in many specimens the lower part of the outside is blackened with soot, and injured by the heat, just like the pipkins used in our modern hearths. In several cases the inside, as well as the outside, was covered over with thick firm soot, a fact which renders it difficult to say to what use they were applied, unless indeed we consider what was inside to be the charred remains of the food or porridge, which was actually in these vessels when the settlement was burnt. Small portions of the fresh-water mussels found in great number in this bay, and which still remain in the substance of the clay, as well as other indications, show that the loam used was from the immediate neighbourhood. It seems probable also that the place of manufacture was at no great distance, from the fact of a quantity of broken gravel and crumbled granite, together with lumps of black lead and ruddle or red chalk, having been taken out of the mud; the two first of which were constituent parts of the material for pottery, and the other two were used for colouring and ornamenting the vessels when made. It is a striking fact that the innate tendency in man to produce in whatever he makes some variety in form or ornament, manifests itself even in these coarse manufactures. No two specimens have exactly the same form, and besides being coloured, they have ornaments on the upper part either impressed or in relief. The ornamentation of fig. 7 appears to be rare; we have not met with it again in any other specimen amongst the large quantity of ornamented pottery brought to light in our excavation. It has

in fact been produced by a rope of two thick strands, twisted together, having been wrapped round the neck of the vessel while the clay was yet moist, and then pressed in upon it.*

While the coarser kinds of pottery just described may have been used for cooking, and for keeping provisions and other substances, the better kind consisting of vessels like bowls or dishes, were doubtless used for eating and drinking. This finer sort was not indeed made of purified clay, but was manufactured simply with much greater care; both inside and outside the vessels were neatly smoothed, and the outside was rubbed with graphite, and polished. The substance of the vessels in proportion to their size is extraordinarily thin; in some specimens there are ears through which cords might be passed for the purpose of carrying them.

Spindle Whorls.—A few of these implements have been found made of clay, one kind thicker than the other; they are exactly like those found in the ancient graves (Plate III. fig. 13.)†

Hazel Nuts.—The only things found here of the vegetable kingdom which were used for food were hazel nuts, of which a large number were met with in the relic-bed, all of them cracked, so that in all probability they had not been brought here merely by chance floods.

A number of fir-twigs, fir-cones, and leaves of oak and beech in the same bed, seem to indicate that in the early ages the shores of the lake were well clothed with forest trees.

* Two pieces of pottery with the same ornamentation have been found at Robenhausen.

† According to Pliny, 'Hist. Nat.' xix. 1, flax had in early times spread through the whole of Gaul.

THE LAKE OF MOOSSEEDORF NEAR BERN.

The settlement in this lake is peculiarly interesting on several accounts: it affords the most perfect example of a regular lake dwelling of the stone period, for no implement of metal was found in it; and from the lake having been artificially lowered, a great proportion of the piles standing near the bank were laid dry. Many circumstances as to the structure were brought to light and a large number of implements of a very early age were discovered, together with a considerable quantity of animal remains, some of which certainly belong to the domestic varieties.

The little lake of Moosseedorf, distant about two hours' walk from Bern, belongs, as its name imports, to that numerous class of lakes in Switzerland called 'Moor lakes.' Its banks are boggy, the bottom is muddy, and the water is thick in summer. Like the rest of the small lakes of Northern Switzerland, it is frozen over every winter. After the water level had been lowered about eight feet in the winter of 1855–6, the remains of two settlements were discovered, one at the east and the other at the western extremity. They were investigated by Mr. Albert Jahn of Bern, and Dr. Uhlmann of Münchenbuchsee, and were described by them with great accuracy in a monograph entitled 'Die Pfahlbau-Alterthümer in Moosseedorf, Bern, 1857.'

Before proceeding to the description of the eastern settlement (which was the only one that could be thoroughly examined), it may be well to give the substance of a report by Dr. Uhlmann on the geological conditions of the immediate neighbourhood. The lake lies nearly east and west in a valley having the same direction. Its present banks consist of meadow land and peat, which is almost changing into black mould; the upper part of this peat is mixed with wood and less dense than the lower part which is more compact; it varies in thickness from one to two feet, to six feet and upwards. Below this lies the original lake bottom of shell marl (weisser Grund, blanc fond), a stratum of

bluish-white, soft, calcareous matter with numbers of snail shells whole and broken. This bed is from one to ten feet thick.* Under this shell-marl is found the alluvial mass of sand, gravel, &c., resting on the molasse, or sandstone of the district. The hills on the north and south sides, which are from 100 to 150 feet high, are either arable or forest land, and consist of regular soil and gravel, below which is the molasse. No trace of either peat or shell-marl is found here.

The views of Dr. Uhlmann as to the geological sequence of events in this district may be given in few words. The bottom of the lake was formed by an accumulation of rounded pebbles and sand from the molasse of the surrounding hills brought down by floods; the water of the lake was probably muddy from the clay which had also been washed down, and the disintegration of some of the pebbles; and a bed was gradually formed at this period consisting in a great measure of the remains of shells then living which is well known as the 'shell-marl' (weisser Grund, blanc fond) of most of the Swiss lakes. While this was accumulating a considerable time must have elapsed; till by floods, or other causes, an accumulation of sand and alluvium took place at the eastern extremity of the lake—the level of the water rose, and thus the formation of peat first began. It rested on the shell-marl, and consisted in general of wood broken to pieces, branches, &c., mixed with mud, sand and stones. As the peat increased, the outlet of the water diminished. The valley became more and more boggy; the peat was formed in the usual manner round about the lake and in the bog to the westward. This condition of things remained till very lately, when by an artificial drain the surface of the water was considerably lowered, and the valley was freed from bog. The formation of peat has now ceased, and the level of the lake lies at the present moment probably some feet lower than in the time of the inhabitants of the lake dwelling.

The little map (Plate IV. fig. 1) will give a general idea of the locality. The eastern settlement marked E, or at least its site, is now in a great measure on dry land: it formed a parallelogram of piles driven irregularly into the muddy bottom, and

* When Dr. Uhlmann was kind enough to show me his collection in 1864, he mentioned that in this shell-marl many of the specimens of Limnæus palustris and L. stagnalis, especially the latter, were larger than those of the present day. He also stated, if I mistake not, that the marl contains Limnæus auricularis, and a species of Paludina, now extinct in the *smaller* lakes.—[Tr.]

was about fifty-five feet broad, and seventy feet long. The piles consist of stems of fir, oak, birch, and aspen, being the kinds of wood found in the neighbourhood: they are from five to seven inches in thickness; some whole, some split, and many with the bark still remaining. Cross-branches laid on the bottom in the manner of a fagot bank, or fagot road, appear like the remains of a bridge or stage connecting the settlement with the shore. Here, as in many other lake dwellings, the upper structure had been destroyed by fire, and only the burnt wood remained. It was very singular that the implements and utensils found amongst the remains of this settlement were met with, not in the mud of the ancient lake bottom, but in the bed above it, called the relic bed, which consists of loose peat, with sand, stones, clay, wood, and charcoal, and varies in thickness from five inches to two feet or more. Many of the implements, the products of human art, lie in this bed very near to the shell-marl, but none of them actually in it, except where the marl is soft and pulpy, so that it naturally follows that they had fallen into the peat which had been gradually accumulating during the existence of these habitations. A very striking circumstance, however, ought to be mentioned, namely, that even heavy implements, such as stone chisels, grinding or sharpening stones, &c., were found quite high in the relic bed, while lighter objects, such as those made out of bone, were met with much deeper.

The meaning of the various letters on the map will be found in the explanation of the plates.

Plate IV. fig. 2, shows the arrangement of the piles on a part of the settlement; the space comprised within the letters A A, C C, is now lying dry.

Fig. 3 is a section which, as well as the ground plan, has been drawn by Dr. Uhlmann, and exhibits the different beds or layers of soil on the bank, together with the piles. The line A represents the ancient level of the water; the line B the present level; *b b* a bed of mud with roots of reeds, but without any artificial objects in it; *c c* is the relic bed, consisting of loose peat, with many stones, gravel, wood, charcoal, bones, &c., and containing the various implements found here—the piles pass through this bed into the lower one; *d d*, the ancient bed of the lake, consisting of loam and mud, with the remains of shells; *e* is compact peat; and *a a* is top of the present bank.

The vignette, fig. 22, Plate V., will give some idea of the appearance of the lake of Moosseedorf; the sketch was taken

standing on the site of the lake dwelling just described. The canal cut to drain the lake may be seen to the right, and is marked by two birds.

A few of the antiquities found here are drawn on the same plate and will now be described.

Plate V. fig. 1. Hafting for a stone celt made of fir-wood.

Fig. 2. Hafting for a celt made of stag's horn.

Fig. 3. Harpoon of stag's horn; some harpoons in the collection of Dr. Uhlmann are double-barbed—that is, each main barb has two points.

Fig. 4. A lance point made out of the shoulder-blade of some large animal.

Fig. 5. Flint saw set in a handle of fir-wood and fastened with asphalt.

Figs. 6 and 7. Needles made of boars' teeth, probably for sewing the garments together.

Fig. 8. Awl made of one of the leg bones of the roe.

Fig. 9. Bone knife with a sharp edge.

Fig. 10. Chisel made of a stag's bone.

Figs. 11 and 12. Two views of a wedge made of fir-wood worked very neatly.

Fig. 13. Bone awl or piercer.

Fig. 14. Fish-hook made of the tusk of a wild boar.

Fig. 15. Boar's tusk ground to a sharp edge like that of a knife on the convex side, and with two perforations.

Fig. 16. Needle or pin made of a boar's tusk.

Figs. 17 and 19. Flint flakes, probably for scaling fishes.

Fig. 18. Arrow head of rock crystal.

Fig. 20. Celt of nephrite, sharp enough to cut skin or leather.

Fig. 21. Comb made of yew-wood two inches and a half broad, and nearly five inches long; it is ornamented with two buttons or projections on one side, and was probably used as a comb for keeping up the hair.

Several of the specimens lately found here are drawn Plates XIV. and XXII.

Plate XIV. fig. 12. A boar's tusk ground to an edge towards the point, and perforated in two places.

Fig. 21. A bone awl with a head or handle made of asphalt.

Fig. 22. A bone knife.

Fig. 25. A bone tool pointed at one end and with the other terminating in pincers.

Plate XXII. fig. 1. An arrow-head of bone beautifully formed

and very finely serrated; the only specimen of the kind which has come under my notice.

Figs. 4 and 25. The antler of a stag neatly polished, perforated at the top, hollowed out below, with a number of perforations all around it.

Fig. 5. Fish-hook made of a boar's tusk; it was manufactured in the following manner: two holes were bored through it; the space between them was cleared away, and the whole was then finished by scraping tools.

The bones of animals, especially those of large ones, were uncommonly numerous, and it is worthy of note that the carcases appear to have been cut up as if by a butcher, for on many of the bones, when taken fresh from the peat, might be seen marks of the stone axes and knives, and the incisions made by the saws. Other bones had the appearance of having been gnawed by carnivorous animals, probably dogs.

Amongst the fragments of pottery found here may be mentioned the portion of a cup with the rim or edge turned over, in which are two perforations, evidently to pass a cord through for suspension. Another fragment of the edge of a cup has a regular row of perforations placed horizontally. Another portion has an upright projection or boss on the side, about twice as long as it is broad, and perforated vertically; this has evidently been also used for suspension. Two fragments of a broken vessel were joined together by means of asphalt and ashes run through holes drilled on each side of the fracture. Some of the earthenware vessels must have been of large size. One fragment describes the segment of a circle which if completed would have been sixteen or seventeen inches in diameter; the edge is thickened, and the top is marked by depressions, about five in a space of three inches, apparently scooped out by the back of the nail of the little finger. Many of the fragments of pottery were covered with a crust of soot either inside or outside.

A notice of the remains of animals and plants found in this settlement will be found in the results of the investigations by Professor Rutimeyer and Professor Heer towards the close of this volume, and it is therefore needless to give the list here. It may however be well to mention that remains of the hare have been found here: from the very great rarity of this animal in the lake dwellings, this fact is a matter of some interest. Burnt wheat and barley have also been found here; and the *Trapa natans*, or water-chestnut, which does not grow in the lake at the

present day. Linseed has also been met with, showing that the cultivation of flax was probably general in the stone age.

In connection with the settlement of Moosseedorf, a discovery made in the immediate neighbourhood is well worthy of attention. Every little hillock in the surrounding marshland, still partially covered with peat and hardly rising above its level, appears to have been a place where flint was worked into implements, for nothing else but flint was found in any of them except some broken white pebble-stones and traces of charcoal; more than a thousand pieces of flint in flakes, cores, or implements intended for some special purpose, cracked off in all sorts of ways, and afterwards hammered to the required shape, were found in these localities. The flakes are found of various sizes, from that of fish-scales up to two inches in length. More or less care was bestowed upon them according to the use for which they were intended. The majority consisted of what may be called plates, rather long and with a sharp cutting edge, and which by further manipulation could be made into little knives, scrapers, saws, and piercers, as well as into the heads of arrows. Dr. Uhlmann says that he has not yet ascertained the use of the small four-cornered specimens.

The colour of these flints is as varied as their form; they are found white, brown, black, red, and bluish, of all shades, also translucent and like agate and chalcedony. The greater part appear to have come from the Swiss Jura (chalk), some few from the Alps. Those of a better kind of stone are doubtless of foreign origin.

The tools used for making these flint implements do not seem to have been of the same material, but of gabbro, a bluish-green and very hard and tough kind of stone. Several of these implements have been met with; their form is very simple, and varies between a cube and an oval. The oval specimens were ground down in one or two places, and the most pointed part was used for hammering.

LAKE OF PFÄFFIKON.

ROBENHAUSEN AND IRGENHAUSEN.

These settlements on the lake of Pfäffikon may conveniently be described together, though the greater part of the interest will be centred on Robenhausen. The little map (Fig. 1) at the top of Plate VI. will give an idea of this lake, both as it existed formerly and in its present dimensions. The peat has formed all round it, and, especially on the south side, has encroached materially upon the water. The sketch given Plate VII. will show the general appearance of this peat moor, the high mountains of Glarus forming a background to the view. The Aa brook, hereafter to be mentioned, runs through the middle of the moor, and the settlement of Robenhausen is intersected by this stream; the exact locality is marked on the sketch by a dark bird.

We learn more about the domestic arrangements of the inhabitants of these early dwellings from the settlements buried in peat moors than from those where the remains are found in the shallows of our lakes. For although in the latter we can readily obtain an idea of the number and arrangement of the piles, and probably of the extent and divisions of the whole settlement, and some portions of the relics are perhaps more easily secured, yet, on the other hand, the excavations in the peat moors enable us to ascertain facts which bear upon the original conditions of these abodes, their development and their destruction. By systematically excavating the settlements in the peat moors, we not only obtain more correct information as to the construction of the pile work, the form, mode of erection and size of the huts, but we even get a glance into the interior. Wonderful to relate, we can walk over the very flooring of these dwellings, abandoned thousands of years ago. We see before us their hearths and their various household utensils. We obtain information as to the industrial habits of the people, the nature of their food, and the mode in which they were clothed. It is only by the investigation of these

singular remains that we can hope to extend our knowledge as to the peculiar object of these settlements, and the degree of civilisation attained by their inhabitants.

Amongst all the settlements found in peat moors, that of Robenhausen in all these respects unquestionably takes the first rank. When the dwelling was first erected, a bed of peat had already begun to form, which was increased both by alluvial organic matter, and by the growth of lake weeds in the stagnant water, amongst the forest of piles; and thus this bed treasured up, as it were, in its bosom all the implements which fell into the water when the floorings gave way, and also the different relic beds belonging to the successive settlements, all in their regular order. Circumstances so favourable to the investigation are not to be found together in any other lake dwelling.

Another fact also is of the greatest importance, both as to the preservation of the antiquities and as to our accurate knowledge of this locality. The greater part of the area of the settlement is the property of one individual, who devotes his time and powers to this scientific enquiry, and gives himself up to the work with an energy and perseverance which deserve the highest praise, more especially as it has to be carried on under many difficulties, and frequently is a trial even to health. This energetic individual is Mr. Jacob Messikomer of Stegen Wetzikon.

Some years ago the inhabitants of this district, when cutting peat in the neighbourhood of Robenhausen, found implements for fishing and other purposes, which led them to conclude that the marshy ground south of the lake of Pfäffikon, and through which the Aa brook flows, was formerly under water, and had gradually been raised. This opinion was confirmed by the discovery of the remains of an extensive lake dwelling in January 1858 by Mr. Jacob Messikomer, in that part of the moor which goes by the name of Himeri. Excavations were commenced on a small scale by the Antiquarian Association of Zürich, and subsequently the works connected with the outlet of the water gave great facilities for the investigation. The examination of this remarkable settlement was undertaken by Mr. Messikomer, and we are indebted to him for an accurate account of the size of the settlement, the construction of the dwelling, and for notices of the antiquities found here. His later excavations have brought to light many interesting remains, amongst which are some which throw considerable light on the

age of this colony. Almost up to the present time it has been considered as a settlement purely of the stone age—no traces whatever of metal had been found in it; but it will be seen from the description of some of the earthenware vessels lately met with, that this opinion must in some measure be modified.

As before mentioned, the lake dwelling of Robenhausen is situated in the peat moor on the southern side of the lake of Pfäffikon. (See Plate VI. fig. 1.) The space covered with piles is nearly three acres; it forms an irregular quadrangle about 2,000 paces from the ancient western shore of the lake, the whole of this distance now consisting of peat, and about 3,000 from the shore in the opposite direction. It was with this last-named side that the settlement, which of course was formerly entirely surrounded with water, communicated by means of a bridge or stage, of which the piles are still visible. The reason why the communication with the land was made in this direction, and not on the side where the land was nearer, appears to be that the gardens and pastures of the colony lay in the sunny district of the village of Kempten, a name evidently allied to Campodunum and of Celtic origin.

The substructure of these dwellings was as usual of piles, consisting partly of whole and partly of split stems ten or eleven feet long, of oak, beech, and fir-wood, sharpened at the end with stone celts or hatchets, and driven a few feet deep into the mud at a distance of from two to three feet apart. Later discoveries, it will be seen, enabled Mr. Messikomer to distinguish the piles of the different settlements by the nature of the wood. The floor or platform supporting the huts was formed, as is evident from the remains still existing, partly of cross-timbers and partly of boards, which were fastened to the upright piles by wooden pins.

The outermost piles are bound together with wattle or hurdle work of branches, forming a kind of defence for the settlement. Large pieces of this hurdle-work have been met with.

The Aa brook, now called the Aa canal, or the outlet of the lake, which some years ago was artificially widened and deepened, runs immediately through the settlement. It is twenty-seven feet broad, and from eight to nine feet deep, and the bed of it is thickly set with the stumps of piles placed in double rows, which were broken when this watercourse was put in order. Plate VI. fig. 4 gives a section of this canal, showing the beds of peat, the relic bed with the floorings made of gravel and clay, and also the remains of the piles themselves.

Fig 3 gives an enlarged section of the relic bed. It is singular that very good peat is found both under and above the floorings, and that wheat, barley, flax, string, woven cloth, &c., are found in the very substance of them. Fig 2 shows the ground plan of a portion of the canal about sixty feet long; the arrangement of the piles is shown by small circles, and the localities are also noted where the different antiquities were found—at least, where they were of especial interest, either from the quantity found together, or from the nature of the objects themselves. Single specimens of woven or platted cloth are not mentioned, nor are the localities indicated where pottery was found, nor animal remains which had served for food; all of which were found in abundance, and probably were thrown into the water through some of the numerous openings so conveniently at hand in the timber platform of the lake dwelling. In like manner, the places are not noted where remains of berries, cracked nuts, bones and scales of fishes were met with, all of which were found lying together in great quantities, and had evidently been thrown into the water by the same holes. No notice also is taken of charcoal, which in fact is spread over the whole area. A curious fact is that in many cases objects are found together which have a certain mutual relation. In one place a considerable quantity of corn (wheat and barley) was found together with bread; in another locality these articles of food were found together with burnt apples and pears; in a third, flax and its different manufactures; and in a fourth, these very things were discovered together with the earthenware cones used for the loom. There can be no doubt that in the first-named two localities there were store-houses of different kinds of grain, and that in this very place the corn was bruised and ground, and afterwards either boiled in pots to a kind of porridge or made into dough with water without separating the bran, and then baked into a kind of cake or bread on hot rounded stones, and under the glowing embers. The large number of granite slabs used for mealing or grinding stones, and found together with the objects last mentioned, prove that the manufacture of meal was carried on here to a considerable extent. The third and fourth localities indicate a large store of flax, which is found here sometimes in skeins, or hanks, sometimes spun, platted, or woven in the form of threads, cords, nets, mats, and cloth, just as in a linen-merchant's warehouse.

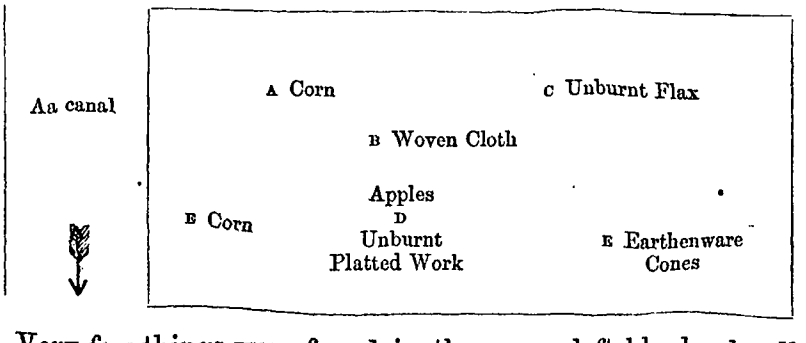
Stone celts, with or without hafting, arrow heads and other flint implements are found in abundance scattered on the bed of

the canal, but to the present time no place where the implements were manufactured has yet been discovered as indicated by refuse flakes and unfinished or imperfect implements.

According to the calculation of Mr. Messikomer, the area of ground examined by him in the canal contains about 4,000 square feet, which is about one-thirtieth part of the whole settlement. At least 100,000 piles must have been used in the whole structure; and if we join to this consideration the fact that the bones and fragments of pottery were so abundant that every shovelful of mud taken from the bottom of the canal at a depth of six or seven feet contained several specimens, and also that the animal remains and the products of human industry here form a bed at least three feet thick, called by us the relic bed, we seem perfectly justified in coming to the conclusion that the settlement lasted many centuries.

Subsequent excavations were made by Mr. Messikomer in an area 100 feet long and 50 feet broad, abutting at right-angles on the Aa brook canal, and several new specimens were brought to light, amongst which were one or two perfect long bows like those used by the South Sea islanders, as well as several imperfect ones; stone celts fixed in wooden clubs; a stone celt fastened in a hafting of stag's horn, which was then fixed in a wooden club, a flint arrow-head fastened to the shaft with cord and asphalt; several implements of maple-wood, such as knives and dishes, some of them perfect and others broken or unfinished; and lastly, a remarkable canoe made out of a single trunk (Einbaum), such as may now be seen in the lakes of Zug and Lucerne, twelve feet long, one and a half foot broad, but only five inches in depth.

The places where these objects were found in the above-mentioned space are shown on the following plan:—



Very few things were found in the space left blank: hardly any of stone or bone, as the chemical nature of the peat is not

only to whiten but to disintegrate the stone, and to dissolve the bone entirely. The few bone implements which were at all well preserved were lying on the top of the shell-marl. The following are sections of the ground taken at three of the localities indicated above :—

Section at B.	Section at C.	Section at D.
½ foot Alluvial Earth	½ foot Alluvial Earth	½ foot Alluvial Earth
3 feet Peat	5 feet Peat	5 feet Peat
½ foot Flooring		
2 to 2½ feet Peat		
½ foot Flooring	1 foot Flooring	1 foot Flooring
Woven and Platted Cloth		
½ foot Flooring	2 inches Unburnt Flax Seed Vessels	4 inches Apples and Charcoal
½ foot Relic Bed	½ foot Relic Bed	½ foot Relic Bed
Lake Sand	Lake Sand	Lake Sand

It will be seen that in the section B woven and platted cloth occurs, as was formerly the case in the middle of a bed of earthen flooring one foot thick, while in both the other sections burnt apples and unburnt flax capsules were found under the floor; and very frequently burnt and unburnt platted cloth are found quite close to each other. The existence of a floor may always be considered to indicate a favourable locality for antiquities; though, as was the case at Niederwyl, only the rooms were covered with an earthen flooring; the open spaces around were without it.

Mr. Messikomer, in his reports on this excavation, says that at first he could hardly convince himself of the existence of more than one floor, and could not comprehend how a bed of peat two or two and a half feet thick could again be covered with a layer of earth, till at length the full explanation of these singular layers appeared in another part of the settlement. The section given Plate XVI. fig. 2, taken during this excava-

tion, shows two systems of piles one above the other, the upper ones of course being the later, as they do not go down to the lake bottom, but were only driven into the relic bed of the previous settlement. The heads of the upper or later piles are about two and a half feet higher than those of the others.

Still later excavations have added materially to the interest of this settlement, for we now know not only of two but of three distinct settlements, one over the other. It will probably be the best to give the account of this very singular fact in the words of Mr. Messikomer himself. The following is an extract from a report made by him to the Historical Society of Switzerland, in August 1865 :—

'Anyone who takes the trouble of descending into one of the excavations made in the area of this settlement, and at present kept free from water by pumping, will remark, about ten or eleven feet deep under the surface, a bed of a whitish-grey colour, consisting of the remains of innumerable small shells, and here called "Weisser Seegrund" (white lake bottom, or in other words Shell-marl), but in Thurgau it is called "Alb." * In this bed no traces of implements are found, but the points of the lowest series of piles have been driven into it. Above this there is a bed about four or five inches thick, greasy and sticky to the touch, arising from the decomposition of the remains of plants, and having the appearance of peat. Implements are found in this bed, but not abundantly. Above this lies a bed of charcoal, arising from the conflagration of the first settlement; it contains grains of barley and wheat, also threads, and pieces of cloth, and fishing-nets, all in beautiful preservation from having been carbonised. From all appearances this first settlement was not of long duration.

'After the catastrophe which had happened to the first dwelling, the colonists erected new homes on the site of their old ones, for above the lowest bed of charcoal we find a bed of peat three feet thick, in which are imbedded bones, pottery, &c., and also the material of an ancient flooring. Then follows again a bed of charcoal with corn, apples, pieces of cloth, bones, pottery, and the usual implements of stone and bone. The huts of this *second* settlement were likewise

* This 'Seegrund' or shell-marl, which covers the bottom of all the smaller lakes, lying in the low districts, and which varies in thickness from a few inches to some feet, and is occasionally burnt for lime, is to be distinguished from the 'blancfond,' which consists of a whitish crust of carbonate of lime, with which the bottom of the larger lakes is partially covered.

destroyed by fire, as may be clearly seen by the burnt heads of the second series of piles. This settlement was erected more firmly than the previous one, for the piles are so numerous that on the average there are three or four in every square foot. The length of time also that this settlement lasted was much greater, as the bed of peat formed during its existence was much thicker.

'Above the second bed of ashes a new bed of peat is spread about three feet thick; in this there are also the remains of a flooring, as well as a number of stone celts either broken, half finished, or in good preservation, some of them are of nephrite: pottery was also found here, as well as other things usually met with in lake dwellings. This settlement must have lasted a long time, but seems only to have extended over a part of the whole area. It is a singular fact that while the piles of the two first settlements reach down to the shell-marl, those of the third settlement were driven into the mass of ground or material arising from the two first settlements. The piles of the upper settlement also consist entirely of split trunks of oak, while those of the two lower ones are round stems of soft kinds of wood. It is also remarkable that in the remains of this third erection no signs of any catastrophe by fire are to be discovered, and we may therefore venture to conclude that the colonists, probably compelled by the increase of the peat, left these abodes of their own accord.

'The reason why no corn, apples, or manufactures of flax, are found in the upper layer may probably be found in the fact that the latest erection was not burnt, for nearly all the specimens of the above descriptions which have come down to us are in a carbonised condition.

'The uppermost bed of the lake-dwelling area consists, like that of the rest of the moor, of vegetable mould. For when the peat had reached to the surface of the water, its growth was checked, and by the decay of the marsh plants under the influence of atmospheric air, a bed of vegetable mould was formed called peat earth, which covers the surface of every peat moor.'

Plate VIII. is a careful sketch of one of Mr. Messikomer's excavations, showing the piles of the settlement of the middle age: they are all of round fir timber, and many of them have the bark still adhering to them. Plate IX. gives a view of the piles of the latest settlement, in an excavation a few yards

Section at the Lake Dwelling of Robenhausen, October 1864.

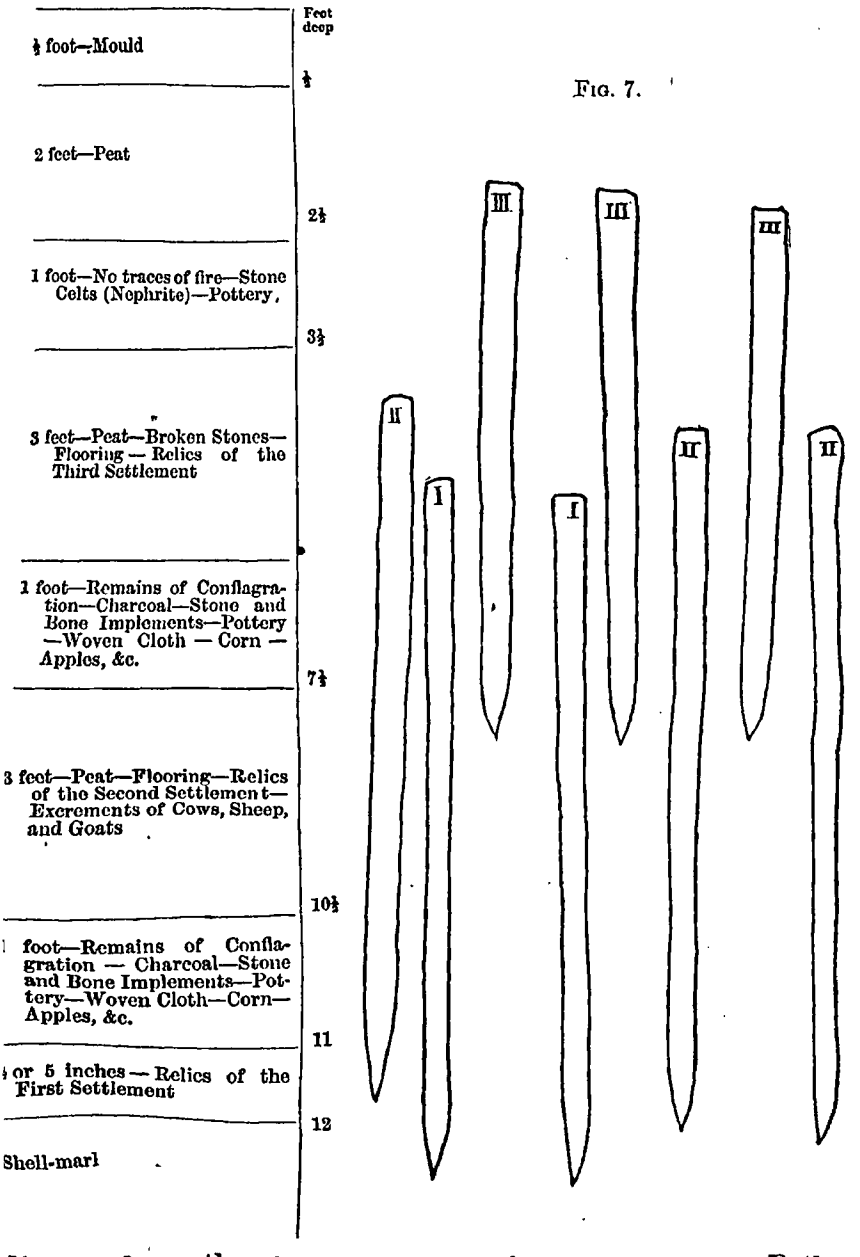


FIG. 7.

distant from the first; they are of split oak-stems. Both sketches were taken on June 20, 1865.

It is a singular fact that the piles of all the three settlements incline from the north-west to the south-east, for which

it is difficult to assign a cause. The piles of this settlement, like those of Niederwyl, are placed in straight lines, which run in the direction of the cardinal points.

A series of observations led to the conclusion that in the space of 150 feet long by 40 feet broad, where the canal ran through the settlement, there were six separate huts standing close to each other in order to economise room. For Mr. Messikomer at each of six different places, all at equal distances, found one of the well-known mealing-stones previously described, heaps of corn, pieces of woven and platted cloth, stores of raw flax, together with the clay weights belonging to the loom, and also great stones which had formed the hearths. It is therefore evident that each hut was inhabited by one family, which had its own arrangements for preparing victuals and for making clothes. The length and breadth of the huts correspond exactly with those of the dwellings found at Niederwyl, namely, twenty-seven feet by twenty-two. Even the construction of the timber floors is exactly the same both at Robenhausen and Niederwyl, although the substructure of the two is so very different.

The stalls for the cattle were distributed between the huts. Mr. Messikomer, who had formerly directed his attention while excavating chiefly to the discovery of implements and bones, has lately begun to investigate the nature and constituent parts of the peaty mud, and he has discovered in it horizontal beds from two to ten inches thick, varying in extent, composed entirely of the excrements of cows, pigs, sheep, and goats, together with the remains of the litter they had used. Some time ago a few of the fæces of goats had been found in a carbonised state, but they were taken for acorns or some other similar seeds. But a careful examination of them by Professor Heer soon revealed the true nature of these objects, so little pleasing in themselves, but so highly interesting when found in a lake dwelling.* With respect to the excrements of cows and swine, we must look for their determination not so much to the eye of the naturalist as to the practised glance of the agriculturist, and we may rely with implicit faith on Mr. Messikomer

* With respect to the goats and their fæces, there cannot be the slightest possible doubt. Dr. Keller has kindly sent to me a small box of these 'Ziegenbohnen (as they are very characteristically called in German), and I have exhibited them to one or two individuals, without giving the slightest hint as to what they were, and yet notwithstanding their carbonisation, their true nature was instantly discovered. In a late letter Dr. Keller mentions that from these deposits being found in regular beds amongst the remains of the settlement, it is the opinion of Professor Heer that they do not arise merely from the sweepings of the stalls, but that they were manure-heaps hoarded for agricultural purposes.—[Tr.]

and his labourers when they assure us that this is the actual nature of these substances. The litter for the cows consisted chiefly of straw and rushes; that for the smaller animals was of sprigs of fir and twigs of brushwood. In these masses of excrement may be noticed the chrysalis shells of the insects which are so numerous at the present day in the manure found in the cattle-sheds.

Before we proceed to describe the more remarkable objects found here, it may be advisable to refer to a curious fact which has been observed by Mr. Messikomer, and which may probably throw some little light on the destruction of the settlement. As peat is now dug here more extensively than formerly, many places are worked at some distance from the bank. If we walk in a northerly direction from the locality of the lake dwelling and examine the pieces of peat which have been dug here and laid to dry, we shall find that they all without exception contain more or less charcoal, while the peat on either side does not contain any. The strip thus marked by charcoal may probably be a few hundred paces wide, and its limits are clearly distinguished. It has before been mentioned that charcoal is very frequently met with in the settlement, indicating its destruction by fire, probably at repeated intervals; and Mr. Messikomer, with very great justice, from the presence of these pieces of charcoal in the above direction, concludes that one at least of these calamities took place at the time of the strong south wind so well known in Switzerland under the name of 'Fönwind,' by which the burnt materials would be driven along on the muddy surface in the direction mentioned, which is the exact course of this wind. If we bear in mind the nature of these settlements built of wood and straw, and so very liable to suffer from fire, and if we have ever personally witnessed the effect of the 'Fönwind' occurring at the time of a calamity of this nature, by which at one time or other nearly every town in central Switzerland has been almost destroyed, we cannot help concluding with Mr. Messikomer, that of the two earlier settlements of Robenhausen, one at least was destroyed by fire during the prevalence of this dreaded wind.

We will now describe the various objects found in the settlement. A few brief preliminary remarks, however, may not be out of place. The animal kingdom is more largely represented here than in any other settlement: the bones are often found together in heaps of from fifty to one hundred pounds; from their weight some of them have sunk eight or ten inches into the bottom of the

lake. As one hundred hundredweight of bones were gathered in the Aa brook canal alone, the mass of animal remains buried in the whole colony must be immense. Scales of fish are found everywhere in great abundance, a proof that fish formed a considerable portion of the food of the inhabitants; they also laid up stores of the water-chestnuts (*Trapa natans*), and also of apples. In one place 300, or half a peck, were found together. Quantities of beech-nuts and acorns were also met with, which probably were intended as food for the swine. The whole weight of the pieces of bread found when the canal was deepened and altered, may be about eight pounds, and would probably correspond with newly baked bread weighing about forty pounds. Of stone-fruit there are more sloe than cherry stones. The seeds of raspberries, strawberries, elderberries, and blackberries, are also met with. The different varieties of corn will be especially described by Professor Heer. Mealing-stones and grinding-stones are common, and so are the hearthstones or those used for baking. Burnt straw, the remains of thatch, is found in abundance, and fragments of pottery with various kinds of ornamentation are met with in countless numbers. The well-known tools of stone, horn, and bone, were very common.

OBJECTS OF WOOD.

Plate X. figs. 1, 2, 3. Knives of yew-wood. Fig. 2 is perfect. Figs. 1 and 3 are imperfect. Fig. 1 has had two holes through the handle.

Plate X. figs. 4, 13, 17, Plate XI. fig. 9, and Plate XII. fig. 7. Dipping-vessels or ladles cut out of wood, some of which, considering the imperfect tools which the makers had at command, show astonishing skill in carving: they are very similar to those now in use in the Swiss milk-chalets. Plate XI. fig. 9, and XII. fig. 7, are of maple-wood: the fragment of a plate of maple-wood was also met with. Plate X. fig. 5 is a small object of wood cut almost in the shape of a little pulley.

Figs. 6 and 15 are made out of bark.

Plate X. fig. 7. A club of ash-wood, in which is fixed a socket or hafting of stag's horn containing a stone celt.

Plate X. fig. 14. A similar club with a stone celt fixed in it, without any intermediate hafting. In both these cases, probably in order to hold the celt more firmly, and also to prevent the club from splitting when used, the head or upper part of the wood projects considerably beyond the plug-hole.

Plate X. fig. 16, shows another mode of fastening the stone celt. The club in this case is formed of the root of a hazel-bush;

the celt is placed between two projections which are set at right angles or nearly so with the main root, and is fastened to them with cords.

Plate X. figs. 8, 8*a*, 8*b*. A boat or 'Einbaum' made of a single trunk, twelve feet long, two and a half feet wide, and five inches deep. *a* and *b* show the longitudinal and cross sections.

Plate X. fig. 9. Flail for thrashing out corn; these implements are not uncommon either at Robenhausen or Wangen. When they were met with, the agricultural labourers of the neighbourhood at once pointed out what they had been used for.

Plate X. fig. 10. A yew bow measuring five feet round the curve, and notched at both ends for fastening on the string. A shorter and more perfect specimen, three and a half feet long, may have been a boy's weapon for the chase.

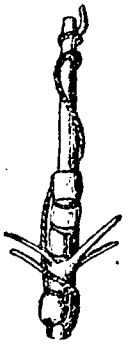
Plate X. figs. 11 and 12. These implements, which are not at all uncommon at Robenhausen, are of peculiar interest; at first they were considered as implements used for the churning or manufacturing of butter, but M. Rochat Maure, the engineer of Geneva, in the following notice, has clearly shown that they are to be considered as fishing implements.

'The fishermen who at the present day use implements of this kind live, while the fish are going up, on the banks of the river Arve, well known for its cold and rushing stream. They pass the night almost like savages under huts made of twigs, and their small subsistence is extremely precarious; they catch the fish in the following manner:—To one end of a cord the length of a stone's throw they fasten a roundish flat stone, and to the other end a heavier stone of any convenient form. To this main cord they tie at intervals thinner strings with hooks at the end, and from three to five feet long. The heavy stone is then let down into the water from the boat at the side of the bank, but the other stone is thrown as far as possible straight across the stream towards the opposite bank. Early in the morning these cords are drawn up and examined, the implement used for this purpose being exactly like those found at Robenhausen. It is in fact the top of a young fir-tree with the branches springing from the main stem like radii. A cord is fastened to the upper end of this kind of hook, and in order to make it sink, some leaden rings or hooks are fastened to the main stem: it goes by the name of "Arpion" amongst the fishermen. It is thrown into the water from the boat, and when drawn up brings with it the thinner cords or those which have the hooks at the end. As the settlers at Robenhausen

had no lead, it is possible that the perforated stones found in that settlement may have been used to sink these implements.'

The annexed woodcut shows the form of the modern 'Arpion,' which is almost identical with those drawn (Figs. 11 and 12).

Fig. 8.



This implement is of great interest with respect to the history of civilisation, for it proves that implements which have actually derived their origin from the highest antiquity are at the present moment used in precisely the same manner.*

I have elsewhere called attention to the fact that the inhabitants of certain places in the Apennines make their pottery in the very same way as the inhabitants of the lake dwellings, and that the products of the two are not distinguishable, age only excepted; I shall presently have to call attention to other relics of a similar character.

Plate XI. figs. 1 and 2. Two celt-handles, for the most part well and carefully made; the first is of ash, the second of maple: they somewhat differ in shape from those previously mentioned, and are not very frequent in the western settlements, where stag's horn haftings prevail. The handle of Fig. 2 is a root in which a kind of beak has been cut out for the insertion of a celt somewhat in the manner of Plate X. fig. 16. Many of the handles of the longer implements used for beating and cutting have a kind of head or knob at the end.

Plate XI. figs. 3, 4, and Plate XII. fig. 6. Wooden clubs; the first is of yew, and is pear-shaped; the last is also of yew, and has a cylindrical head with incised rings.

Plate XI. fig. 5. A float or support for nets made of the bark of the fir-tree. Implements of this kind are found of various sizes and in great abundance.

Plate XI. figs. 6 and 7. Suspension hooks. Fig. 7 is sixteen inches long. Objects of this nature of different sizes are found in great numbers; they belong to the furniture inside of the huts; no room appears to have been without them. They consist of a portion of the stem of a fir or pine tree cut off lengthwise, and having upon it a branch slanting upwards cut off at some little distance from the stem. They were doubtless

* My friend, Mr. G. W. Nicholl, of Ham Court in Glamorganshire, who lived for many years at Usk—a place where old customs seem to linger with remarkable pertinacity—informs me that a similar implement was made use of within his memory, in the river there when swelled by floods from the hills; it was employed to secure any of the floating objects brought down by the stream.—[Tr.]

fastened to the walls or sides by wooden pegs driven in through the incisions on each side, and used for hanging up implements and clothes.

Plate XI. fig. 10. A great tub cut out of maple-wood.

Plate XII. fig. 3. An implement made of fir-wood, in shape like a chisel: it is imperfect.

Plate XII. fig. 10. Amongst the implements made of wood the most remarkable is a last, or rather a form or pattern, according to which the leather was cut for the coverings for the feet, the soles of the sandals with the straps belonging to them. This pattern resembles the modern lasts, but with this difference, that the bottom of the sole is flat, and not hollowed out to fit the foot like those of the present day. This implement, as the drawing shows, is imperfect, but the first glance will enable us to decide that it has been used for the above-mentioned purpose, and this is confirmed by the opinion of several shoemakers to whom it was submitted. The discovery of this last, which indicates an advanced stage in the art of clothing, is not at variance with our knowledge of other parts of the dress, as, for example, of the specimens of artistic cloth drawn Plates LXXXIV. and LXXXV., and more especially the fringe (Fig. 7) of the first-named plate, all of which betray a certain refinement of life and a tendency to luxury.

Plate XII. fig. 11. Knife or chisel of yew-wood.

Plate XIII. fig. 2. An implement of wood which is of interest, as it may indicate the connection between the stone and the bronze periods. It is only a fragment, and we are therefore unable to report anything as to its use. It may be conjectured that it was an ornament; but it is quite uncertain whether it was applied to the hut, to the canoe, or to any household implement. It is of oak-wood, and is a portion split from rather a thick trunk. The outer side, which is arched, is worked smooth, while the inner side, which is flat, is sculptured into a series of projections and incisions, clearly showing that they have been made by the strokes of a hatchet of small power, doubtless of a stone celt. What makes this piece of wood of interest is the arrangement of the incisions, in which we recognise the earliest application of the zigzag or hatched ornament—a design which is so often repeated on the earthenware vessels of the stone and bronze age, but especially in such different modifications on the bronze implements of the latter period.

Plate XIII. fig. 4. A celt-handle, in which the stone was fixed into the wood without any intermediate hafting.

Plate XIII. fig. 5. A wooden implement somewhat in the form of a spoon, except that it is perfectly flat on the upper side; the sections to the left of the figure will show the form of the opposite or convex side.

Plate XIII. fig. 3. Yoke made of a hazel rod cut so as to carry a vessel.

Plate XIII. fig. 7. The top of a pile cut away in the middle for the support of the cross-timbers. Similar heads of piles are found at Niederwyl.

Objects of Bast and Flax.—The interest attaching to the manufacture of these materials, whether platted, spun, or woven, is such that a special chapter is devoted to them towards the close of this volume; and it will therefore only be necessary here to state that numerous varieties of platted bast and of flax-yarn, thread, string, as well as platted and woven cloth, have been found at Robenhausen, and the reader is referred to the special chapter for any remarks respecting them. There are, however, one or two specimens which have been found very lately, and which, as they are not drawn in the plates appropriated to that chapter, will now be mentioned.

A piece of linen cloth was found here of the usual make, but it has a neat seam or border, which is extremely rare.

Plate XIV. figs. 2 and 6. Balls of string not in the least burnt. It is very singular that amongst the remains of conflagration and in the middle of worked and unworked flax which has been burnt, pieces of cloth and balls of wound yarn are not uncommonly met with which are quite uninjured, and yet when exposed to the air become so shrivelled and altered that their original form is hardly discernible. Fig. 6 shows the remains of a ball of string rather more than half unwound, which may be considered as what is called a warp or a ball of string wound ready for the weaver.

It ought to be mentioned here that though the proofs of the cultivation and manufacture of flax are manifest in no other lake dwelling to such an extent as at Robenhausen, yet, in spite of the most careful examination of the relic beds, no spindle-whorl has yet been found here, while in some other settlements where these implements are found in abundance no traces of manufactured flax are met with.

Amongst the latest discoveries at Robenhausen is a piece of a mat or covering of some kind, made with a good deal of skill. It consists of several layers of a net-like plat, made of strips of bast from the willow or the lime-tree, bound together

with flax-strips. Colonel Schwab thinks that the whole material consists of bast. The layers are not horizontal, but lie one over the other like tiles. This specimen is drawn Fig. 6 of the supplementary Plate XCV.

Objects of Horn and Bone.—Stag's horn is very generally used for the intermediate hafting of stone celts, between the celt itself and the wooden club forming the handle; one of these is drawn Plate X. fig. 7. Piercing and scraping tools, probably used in the ornamentation and shaping of pottery, as well as for various other purposes, such as arrow-heads and daggers, are found in great numbers made out of the bones of various animals and the ends of stags' horns.

Plate X. fig. 18 is a little implement, somewhat bent and notched at the smaller end, made of stag's horn.

Plate X. fig. 19. A flat implement of stag's horn used for knitting or netting. The notches on both edges, in fact the whole surface, have become polished by use.

Plate XII. figs. 2 and 9 are probably agricultural implements. Fig. 2 is the piece of a stag's horn ending in two antlers, and cut off from the main stem. This tool might be used either as a single or a double spiked hoe. Fig. 9 is a piece of stag's horn cut off square at one end, and diagonally at the other; at the sloping end it has been hollowed out. It may have been used as a trowel for garden purposes.

An implement in the shape of a triangular shovel, with an attached spike, was also found, made of stag's horn, more than two inches broad at the edge and about four inches long; its use is unknown.

The implements (Plate XIII. figs. 10 and 14) seem to have been scraping tools of some kind or other. Fig. 10 is simply a piece of stag's horn cut diagonally so as to form an edge, and Fig. 14 is the shoulder-bone of some quadruped sharpened at one end into a shovel-shaped form.

Plate XIII. fig. 1, is a portion of a rib bound round with string, possibly part of a bow.

Fig. 3 of the supplementary Plate XCIV. is the drawing of a pick or agricultural tool lately found, made of stag's horn.

Objects of Stone.—It is almost needless to say that stone celts were found here of the usual forms; they occur more or less plentifully in every station of the stone age. A very singular stone implement is drawn (Plate XII. figs. 4 and 5) in different views. It is a circular disk of tough stone like serpentine, with a round hole in the middle.

Plate XIII. fig. 13. A flint arrow-head particularly well made. Fig. 6 is a low cone or hemisphere of white marble from Splügen, with two holes in it.

Under this head may probably be mentioned a small drinking-cup made of asphalt. This mineral is found at Val Travers (Canton of Neuchâtel), in Alsace, at Seyssell near the 'Perte du Rhône,' &c. It was used to make small vessels, for mending broken pottery, for fastening stone celts and flint arrow-heads into their handles and shafts, and also for the actual handles of pointed tools. (See Plate XIV. fig. 21.)

OBJECTS OF CLAY.

Plate XI. fig. 8 is an earthenware spoon.

Plate XII. fig. 8 is a small earthenware vessel well burnt, with two ears for suspension. Fragments of pottery in the shape of urns, plates, and cups are abundant.

Plate XIII. fig 8 is an earthenware vessel with a handle; and Fig. 9 is a similar vessel, but with two handles and coloured black.

Fig. 11 is an earthenware cup of the most common form. In Colonel Schwab's collection there is a vessel half finished, proving that the pottery was made on the spot.

Fig. 12 is a cone made of clay mixed with charcoal-dust; it is perforated at the top, and was probably used as a weight for the loom.

Plate XIV. figs. 4 and 5. Borders or rims of earthenware vessels. Fig. 5 shows the commencement of the zigzag ornament.

Crucibles or Melting Pots.—Some years since an earthenware vessel of peculiar form was found which was then considered as a water-ladle; since then half-a-dozen similar vessels have been found, most of them very lately, and as they evidently have been exposed to a violent heat, we are enabled to decide on the true use of these specimens. All have at the edge a kind of drossy coating coloured like a deposit of copper, and in some places like the variegated copper ore. In three cases there were lumps of melted bronze, and in one instance a lump of pure unmelted copper. These vessels were consequently crucibles, in which small portions of this metal were melted down. They nearly all had handles by which they might be taken out of the fire. As no other trace of metal is found, or at least has yet been found in the whole lake dwelling, there can be no

doubt that we have here good evidence of the first attempt to work this material, and that we are on the borderland between the civilisation of the stone and the bronze ages; it is very evident also that this attempt has been made by no ignorant hand, but by some one well versed in this kind of work. The material of the crucibles is clay mixed with horse-dung, a combination which is now used for moulds in which brass is cast.

Plate XIV. figs. 14 to 20 (of which some are drawn in section) will give a general idea of these implements; and Plate XXI. fig. 14 is a sketch on a larger scale (half the full size) of the crucible containing portions of metal still remaining: the places where these portions still adhere are marked with a red tint.

It would be a matter of no small interest to ascertain how the colonists got their copper, for, according to the views of different antiquaries, it was not brought into central Europe either from the north or the south in a pure state, but mixed with tin in the shape of bronze. Although the discussion of the difficult question as to the origin of bronze in general, and the mode in which it spread over central Europe, may not seem to belong to the present account, yet I cannot help making the following remarks, which bear on copper found in the crucibles. As we see that the colonists in the stone age undoubtedly possessed various substances which they obtained from a distance by exchange, such as amber, glass beads, nephrite, and various kinds of flint, we may be certain on the other hand that these same people thoroughly examined the valleys and mountains of their country, in search of any objects which might be useful to them. Thus we find amongst the materials used for different purposes red flint probably from Bavaria or the Vorarlberg, micaceous schist from Davoz, Scaletta, and Fluela in the Grisons, red sandstone now used for whetstones from Rheinfelden (Aargau), crystals from the High Alps, asphalt from the Val Travers (Neuchâtel), white marble from the Splügen, &c. May we not venture to assume that the colonists, by their intercourse with strangers who were acquainted with the nature of metals, were incited to search their country for copper ore and to try to melt it and cast it? Copper ore (Kupfergrün)* is found on the south side of the

* 'It is said that the mine at the Mürtschenstock, 5,284 feet above the level of the sea, was worked by people from Basle, in the place called Feldried, and was given up in the fourteenth century at the time of the "black death." Some inconsiderable hollows at the head of the load seem to confirm this tradition, as also the remains of

Mürtschenstock on the lake of Wallenstadt; and it is known that both in ancient times and even within the last ten years mining was in operation there, and four of the old pits are still known. Slag from the melted copper ore is still to be seen in the Mürtschenalp. The variegated copper ore was mined both in ancient and modern times at the Daspinerhorn near Andeer in the Grisons, and grey copper ore, which was also used in ancient times, is found at Obersaxen near Ilanz in the Grisons. It can hardly be doubted that when once the nature of copper and its fitness for tools became known, it would be everywhere sought for. The author Posidonius, who calls the Helvetians 'rich in gold,' shows how assiduously in early ages they washed gold out of the sand of their rivers.

Before concluding this account of Robenhausen, one of the most interesting of all the lake dwellings yet discovered, it may be well to recapitulate the main results of the latest investigations of the locality.

1. The founders of the settlement were perfectly acquainted not only with the cultivation of wheat, but also with that of flax, and they knew also how to manufacture this last material—by spinning, platting, and weaving—into thread, string, rope, nets, and cloth of various descriptions. Even at Moosseedorf, where till lately there has been a doubt as to any traces of the cultivation of flax, Dr. Uhlmann has recently met with linseed, and thus proved that the settlers there were acquainted with the cultivation of this plant. In fact it seems as if the conclusions arrived at respecting Robenhausen will also apply to all the stations of the stone age.

2. The nephrite, which according to the latest investigations is to be considered as a foreign material, not found in the district of the Alps,* was not brought by the settlers with them

walls and slag in the Feldried. In any case the mine must have been an ancient one, for in these old holes there are no traces of blasting.'—Stöhr.

* Professor von Fellenberg has done valuable service to the cause of science by a careful analysis of the nephrite found in the Swiss lake dwellings, both by deciding the true nature of this stone, and also by bringing the question to a point—whether this nephrite is a native production or a foreign mineral probably brought out of the east. In an interesting paper, 'Analysen einiger Nephrite aus den schweizerischen Pfahlbauten, Bern, 1865,' he sums up his views on the origin of this stone in the following proposition:—'We may with great probability affirm, so far as component parts are to be relied on to prove the identity or non-identity of two uncrystallised minerals, that the stone celts of Meilen and Concise are of genuine nephrite (whether of the New Zealand kind or not is doubtful), but that that from Moosseedorf is of jade (vert oriental). One question yet to be decided is, whether the nephrite found in our lake dwellings

from their earlier abodes, but was acquired by barter in later times, after they had lived for centuries in the lake dwellings of our country.*

3. The settlers, as has been supposed before, were in early times acquainted with copper and bronze, for traces of the working of these materials have been met with in the lower beds of the stone age settlements, before the appearance of nephrite.

4. If we compare the implements of the three relic-beds, there is no evidence of any important difference or of any striking improvement either in material or form. The products of the potter's art remain nearly the same as to the workmanship, the shape, and the ornamentation. The assertion that the perforated celts belong to the end of the stone period has not been proved. It is only in the relic-bed of the third settlement, where the nephrite first appears, that greater dexterity is to be remarked in the mode of working flints. From all this it may be assumed that the civilisation of the colonists underwent no material change during the many centuries of the stone age.

5. The cattle, their stalls and winter stores, were not kept on land as was formerly supposed, but on the lake dwellings themselves. (Compare the passage in Herodotus v. 16.) Although this statement is based only on the observations made at Robenhausen, there cannot be the slightest doubt that the manner of life was the same in the different lake dwellings, and that what is said of these settlements will also apply to all the

may not also have been of Swiss origin, like the celts more commonly found with it, made of serpentine and siliceous schist, for the serpentine and chloritic schist mountains which occur in the New Zealand nephrite districts are found also in Switzerland, widely spread to a considerable extent, as in the Grisons and the Valais; and very possibly also may show segregations of nephrite. Still it has never yet been found here, so that the supposition of its eastern origin, as far as the proofs have hitherto gone, may perhaps be considered the more correct and probable.'

This view of Professor von Fellenberg, that nephrite is a foreign mineral, is borne out by the facts that hitherto no Swiss geologist has found it either *in situ*, or in the shape of gravel; and that no unworked pieces, nor any waste or chippings from it, have yet been found in the lake dwellings.

* My friend, the Rev. C. W. King, who has made the ancient precious stones his peculiar study, in a late letter has sent me the following extract from Anselm de Boot, Gemm. et Lapid. Hist. ii. 109:—'Lapis nephriticus . . . adfertur ex Nova Hispania. In nonnullis etiam Hispaniæ locis et in Bohemia reperitur, sed paucis adhuc notus est, quia a lapidariis imperitis pro smaragdo, prasio, vel pro iaspide habetur.' Mr. King remarks that De Boot's opinion upon the point is to be relied on, for he describes the stone minutely and accurately from several specimens in his own possession, and proceeds to relate numerous proofs of its curative powers within his own medical experience.—[Tr.]

others; nor can we hesitate to believe that discoveries will shortly be made at Wauwyl, Niederwyl, and other settlements buried in peat which will confirm this opinion. With respect to those stations, the remains of which are found in the lakes themselves, no similar result is to be expected. This fact to a considerable extent confirms and establishes our views as to the mode of life amongst the inhabitants. We may now consider the lake dwellings as insular settlements or fortresses occupied not only by the inhabitants with their household property, but also by their herds, with the stores of fodder and the sheds required for their accommodation.

Several places in the lake of Pfäffikon were formerly considered as the sites of lake dwellings on account of a few piles and some antiquities having been found in them, but later investigations have shown this to be more than doubtful. This remark applies to Pfäffikon, to Riedbühl, and to Himmerich. In the latter place there is a singular bank or dam a few paces from the shore, fifteen feet broad and about 600 feet long, as shown (Plate VI. fig. 5). Mr. Messikomer has dug through this bank in several places, and found Roman tiles and pottery.

One other locality, however, on this lake was undoubtedly a settlement of very considerable interest, as the arrangement of it was peculiar, and some of the antiquities found in it are quite unknown in any other lake dwelling. The settlement of Irgenhausen was situated about 200 feet from land near a hill crowned with the ruins of a Roman castrum. The lake dwelling ran parallel with the shore, was about 300 feet long, and thirty feet broad; when the lake was at its average level, it was covered by about nine feet of water. Apparently it consisted of a single row of huts; for there are heaps of stones at nearly equal distances apart, on each of which there was a mealing apparatus—both the nether stone and the corn-crusher together, as if they had sunk into the water when the settlement was burnt. Probably there have been altogether from eight to ten huts. The antiquities hitherto found here are corn of different kinds, such as wheat, barley, millet in the shape of bread, also woven cloth, and lastly, what has never yet been found before, and what could hardly have been expected, the remains of actual embroidery.

These specimens consist of the simple well-known cloth of the lake dwellings (such as that drawn Plate LXXXIV. fig. 8), on which various designs have been formed by means of a needle

and thread. Only about half-a-dozen specimens have been found of this embroidered cloth, and they were sewn together with thread, and appear to have been cut off from a larger piece. A drawing of a part of this cloth is given, Plate XCIV. Fig 2 represents this portion with its constantly recurring pattern, one-third of the natural size. Figs. 2, *a*, show the different patterns of ornamented cloth, and *g* is a piece of the plain cloth used for the 'groundwork,' drawn of the natural size.

A kind of cloth has also lately been found here which appears to be new, and is almost a coarse pattern of what drapers call 'checked muslin.' It has been made simply by an alternation in both directions of rows of five or six fine threads, with rows of probably the same number of stronger ones, almost amounting in thickness to small string.

WANGEN.

It has now been ascertained that nearly every part of the shore of the Untersee was studded with lake dwellings. All of those which are known will be mentioned in the geographical list; but there are some settlements which have been so carefully examined that they deserve an especial notice, and none more so than Wangen, which has been so well investigated by Mr. Caspar Löhle; it is, in fact, to him that we are indebted for the greater part of what we know as to this locality.

When the first account was published of the discovery at Meilen, Mr. Löhle remembered having seen similar objects near his house, and first began to collect the antiquities found on the shore in the autumn of 1856, and also during the winter when the depth of the water was favourable. He subsequently began to excavate, and laid bare a considerable portion of the area occupied by the lake dwelling, when he was rewarded by the discovery of several things not previously known, such as ears of barley, and woven linen cloth, besides an extraordinary number of stone and bone instruments.

The lake dwelling of Wangen lies east of the village, in a bay which is sheltered from the violence of the west wind by a point of land called the 'Wangenerhorn,' in a place called 'im Gau.' A fruitful tract of land extends from the bank of the lake to the sunny slopes of the neighbouring hills. The piles run along the shore, now partially encroaching upon it, and form a parallelogram of more than 700 paces long and 120 paces broad. In some places the bottom is gravelly, in others it is covered with mud. On the side of the lake the piles are about three feet deep in the ground, on the side of the shore they are six or seven feet; for in the course of centuries a mass of organic matter has been deposited here, and also a very considerable quantity of gravel and sand has been washed down by the action of the waves, so that the original lake bottom is now covered by a bed about three feet deep. From the circumstance that the piles farthest from the shore can, in winter, be reached dryshod when the water is at its lowest level, it seems to follow, as there has

been an accumulation of two or three feet of alluvium, that during the last 3,000 years there has been no decided change in the level of the lake. It is hardly to be supposed that the dwelling, in its original state, stood part of the year in the water and part on dry land.

The piles consist of the different kinds of wood growing in the neighbourhood—viz., oak, beech, elm, birch, fir, ash, alder, maple, and two kinds of willow. They are either whole stems, or they are trunks split into two or three parts; and they have been sharpened in some cases by fire, and in others with stone celts.

They were driven in for the most part one or more feet apart, so that in the space of a square rod there are at least twelve, though sometimes seventeen or twenty-one may be seen. In some places, however, where a firmer support was necessary, three or four piles are found driven in close together. The whole number of piles, forming the substructure of this settlement, is estimated by Mr. Löhle at from 40,000 to 50,000.

Of all the dwellings of the olden time yet examined, none has afforded such an abundance of implements as Wangen; they were found in the 'relic-bed' about two feet below the surface; and as many of them are particularly remarkable, it will be well to describe some of the most interesting.

Stone Celts.—These tools have been found to the number of many hundreds, of different sizes and shapes, and in every stage of manufacture, a convincing proof that they were made in this very locality. The rolled stones of the neighbourhood, originally derived from the Rhætian Alps, formed the material for the greater portion. Only a very few specimens were made out of an inferior kind of nephrite. It is, however, remarkable that the majority of the celts, hammers, and other implements found here were of decidedly inferior workmanship, and were quite common tools, just made for the necessities of the case; they are not at all to be compared with the corresponding implements found at Mänedorf, Meilen, &c.

Cylindrical hammers of serpentine, with a haft-hole, and in general perforated stone tools of any kind, are the greatest rarities; on the other hand, stone hammers of a cubical form, with the edges rounded, made out of hard sandstone, are uncommonly numerous. Cutting tools made out of yellowish black and red flint, such as saws hafted in wood, and fastened with asphalt, arrow and lance-heads, are found in tolerable abundance. As this kind of flint is chiefly found in the neighbouring parts

of France, we may consider these implements, or the material out of which they were made, to have been articles of barter.

Pointed tools, little chisels, arrow-heads, &c., made of the bones of stags, roes, and other small or large animals, and even of birds, have been found in extraordinary numbers and of all shapes; and the same remark will apply to the larger pointed tools, to the great awls or piercers, the daggers and the lance-points made out of the horns of stags and roes. Some of the bone arrow-heads have the asphalt still remaining which helped to fasten them to the shaft. A piece of stag's horn, blunt at one end and running to an edge at the other, exactly like that drawn Plate XIII. fig. 10, with a hole through it in which a handle is firmly wedged by splinters of bone, was considered, both by Mr. Rey and also by Mr. Löhle, as a tool used for horticulture.

The earthenware vessels are not different, either in form or material, from those found at Meilen, Robenhausen, and Moos-seedorf. Even the ornaments, consisting of impressions and bosses, are exactly the same. It may be remarked, however, that most of the vessels are of the most simple shape, approaching that of a cylinder, and that many of them are coated either inside or out with a thick covering of soot.

Spindle-whorls of clay are found in abundance.

Perforated balls of clay, mixed with a large quantity of charcoal-powder, like the material of the conical objects found at Robenhausen, are also met with by dozens.

Slabs of sandstone with lines or furrows made by grinding the stone celts upon them, and also others which have been used as hearth-plates, are very abundant.

Amongst the objects of peculiar interest may be mentioned the large quantity of corn which has been dug up in many parts of the area of the lake dwelling, both in whole ears and in separate grains, but always in a burnt state: the two-rowed barley (*Hordeum distichum*) and wheat, both of excellent quality, may be easily recognised. Of wheat there are two varieties, the common wheat and the two-rowed corn, or what is called summer corn. In one place where there was doubtless a store, more than a bushel was found. The fruits of the wild apple and of the wild pear were also met with turned to charcoal in a similar way. In some places there were large quantities of the husks of pine-cones, beech-nuts and hazel-nuts, the seeds of crabs and wild pears, with the small stalks of these fruits, and the seeds of raspberries and brambleberries: these evidently were the refuse of the colonists' feasts.

In the course of several excavations which have been made by Mr. Löhle, he believes that altogether he has obtained nearly one hundred bushels of corn of various kinds, so that there can be no doubt that the colonists carried on agriculture to a considerable extent. It is also a matter of peculiar interest to find that in one of his later excavations, Mr. Löhle has discovered actual baked bread or cake, made of the crushed corn, precisely similar to that found about the same time by Mr. Messikomer at Robenhausen. Of course it has been burnt or charred, and thus these interesting specimens have been preserved to the present day. The form of these cakes is somewhat round, and about an inch or an inch and a half high—one small specimen, nearly perfect, is about four or five inches in diameter. The dough did not consist of meal, but of grains of corn, more or less crushed. In some specimens the halves of grains of barley are plainly discernible. The under side of these cakes is sometimes flat, sometimes concave, and there appears no doubt that the mass of dough was baked by being laid on hot stones, and covered over with glowing ashes.

Some other burnt masses, which have been considered as the remains of vegetable food, appear really to consist of leaves.

It was not entirely for the production of corn that the ground was cultivated; the growth and manufacture of flax evidently occupied no small share of the attention of the colonists: it is found in all stages, from the unworked stems with the capsules still adhering to them, and in perfect preservation, to the most beautiful specimens of platted or woven cloth.

In the same bed of mud which contained the remains of piles and household implements, there were found, as in other lake dwellings, quantities of moss, rushes, bark of trees, wisps of straw and small twigs, part of which probably formed the roofs of the huts, and part may have served for the bedding of the colonists.

It may be well here to mention, that besides the different kinds of wood used for piles, as before stated, some others were found at Wangen, such as the hazel, the apple, and the pear-tree. The stems of the two last were not used for piles, but for hewing blocks on which the colonists worked; they were found lying down, and partially burnt: they are about a foot and a half in diameter, and two or three feet long. Fir-wood and the kinds allied to it are rare, doubtless because it was not to be got conveniently; for the pine forests are on the mountain heights, at some distance from the shore. Only some small

traces of yew-wood were discovered here. There is some little doubt as to the cherry-tree, the actual stems have not yet been met with.

Amongst the few bones which have been found at Wangen, Dr. Rengli has recognised those of the urus (*Bos primigenius*, Owen), and the aurochs (*Bison priscus*, Owen),* the stag, the roebuck, the wild boar, the wolf, the fox, and the dog.

In one of Mr. Löhle's later excavations he made the singular discovery that some of the piles are twisted up in an extraordinary manner; that is, they had been pushed out of their upright position and bent or pressed together thus, ; so it is clear that the weight of the superstructure must have been very considerable. In these cases several strong piles had been placed underneath, to increase the strength of the substructure, to shore up the platform, and to prevent it from sinking further and going to ruin.

Mr. Löhle has also mentioned another peculiarity respecting this settlement: the antiquities are by no means evenly spread over the whole of its area, but there are certain places where they are found in greater abundance than in others; and there are also places which have proved entirely barren, even after a very careful search. Thus the burnt or charred flax is only found in certain localities tolerably well defined, and from four to six square rods in extent; but it is in all stages of manufacture, in stems with the seed-vessels still remaining, in bundles, or what are technically called 'heads,' very well put together, spun into threads, or made into neat and artistic plat with bands of willow-bark or withy-peel. Mr. Löhle is quite right in supposing that these places must have been the spinning-rooms of the colonists, or their store-rooms for flax in its different stages. In the same manner there are localities where straw and straw-plat are plentiful.

There are also certain other peculiarities respecting the antiquities found at Wangen which are worthy of notice. Notwithstanding the very large area which has been examined, and the great quantity of stone implements which have come to light, only one single case has occurred of the celt having been hafted in stag's horn, like those which are found abundantly in nearly all the older lake dwellings. The mode in which the stone celts

* These two animals do not stand in Professor Rütimeyer's list from Wangen.—[Tr.]

were here almost exclusively hafted, was by means of a double or forked branch of a tree, one portion of which, intended to receive the celt, was cut off some inches above the joint or point of junction, and then split; the other was left long, so as to be used as a handle. As in the case of similar implements made by the aborigines of North America, it was quite necessary, in order to fasten the celt or hatchet, to have the two parts of the split branch bound round tightly by strings of bast or vegetable fibre, flax-cords, or thongs of leather. From the length of the handle, Mr. Löhle concludes that these tools were used sometimes with one hand, and sometimes with two. The kinds of wood used for this hafting or handle were chiefly the hazel and the willow.

One or two more peculiarities of the settlement of Wangen may also be mentioned: the perforated balls of clay, mixed with charcoal, seem to be found in no other station; while the black perforated cones of similar material, so abundant at Robenhausen, are not met with here. The clay rings also, so common in the western lakes, and the roundish stones with furrows, or what are called sling-stones, are not found in the east.

On the whole, this settlement appears to belong purely to the stone age, and this is the more remarkable as the inhabitants evidently were pre-eminent both as agriculturists and as handicraftsmen. They produced many sorts of beautiful corn and flax, and they manufactured several descriptions of both platted and woven cloth. All these productions, the result apparently of a settled mode of life, and of peaceful industry, stand in striking contrast with the wretched implements and tools made of bone, stone, and wood; and we cannot wonder at the question arising, whether we are to look upon these colonists as in the full possession of their acquired civilisation, or whether, by long wandering and moving from one inhospitable region to another, they had degenerated, and having sunk into a kind of barbarism, had fallen back upon hunting and fishing, and carried on agriculture, once their chief support, only as a remembrance of their former better condition.

A few of the antiquities found at Wangen shall now be enumerated. Amongst the more interesting objects are the manufactures of flax; but as these will all be described in the chapter specially devoted to this department of the industry of the lake dwellers, it will be sufficient here merely to refer to them. Probably that drawn in the upper part of Plate LXXXVI. is the most curious; it looks like the top of a cap.

platted out of flax. Several of the specimens also in Plates LXXXII., LXXXIII., and LXXXIV. were found at Wangen, and will be described in the above-mentioned chapter.

The spindle-whorls drawn Plate XXI. figs. 11 and 12 are connected with the manufacture of flax, and may therefore be appropriately mentioned here: they are of clay; one is ornamented with lines and the other with dots.* Figs. 7 and 8 are perforated balls of clay, mixed with charcoal-dust; these balls were formerly considered as fire-balls, used by an enemy, when heated, to set the lake dwellings on fire—an opinion which appears to me very fanciful. Fig. 9 is a club made out of the branch of a tree with a wen-like appendage, which had been cut into a round form. Several implements of this kind have been found at Wangen.

Fig. 10. Flint saw set in the small branch of a stag's horn.

Fig. 13 is a portion of burnt straw, lying close together as if it had been thatch.

Fig. 6. Vessel of earthenware made of grey clay, mixed with little stones and with incised ornaments, doubtless the best-made specimen of pottery found there.† In the pottery

* In the 'Palafittes' of Professor Desor, lately published, it is stated, page 68, that stone spindle-whorls are characteristic of the stone age, and clay spindle-whorls of the bronze period. This proposition is not universally valid, as the above notice in the text will show. Clay spindle-whorls are found in many other settlements of the stone age besides Wangen.

† In Sir John Lubbock's work on 'Prehistoric Times,' lately published, page 136, some doubt has been thrown on the accuracy of this drawing, apparently judging merely from a cast. It seems to me that in the case of rough specimens, like the one under consideration, a cast is rather doubtful evidence on which to rely, and I therefore, when at Zürich last summer, brought the matter before Dr. Keller. He informed me that formerly the portions from which the drawing was 'restored' were much larger than at present; but by some means or other parts were broken off, and he immediately produced the remaining pieces. From what he remembers of the original fragments, he is quite convinced that the 'restored' drawing gives a fair idea of the original, and he requested me to reproduce it. I have also given on Plate XV. drawings of the pieces *as they now are*, for the accuracy of which I can vouch, and which, to a considerable extent, bear out the correctness of Dr. Keller's original figure. Individually I prefer that antiquities should be drawn in their present state and not 'restored;' but the custom of foreign antiquaries is quite the reverse, and when there can be no doubt as to the form, &c., they consider that 'restoration' is necessary to do justice to the subject. Dr. Keller informs me that he has been blamed by German antiquaries for drawing several antiquities as they now are, and not representing them restored, or in their original state.

May I add that even if the markings on this vase were intended for leaves, *which was never stated in the description by Dr. Keller*, I do not see very clearly why they should have excited the surprise of Sir John Lubbock? Some implements of the reindeer age from Bruniquel, lately placed in the British Museum, exhibit very fairly drawn outlines of animals' heads, which unquestionably are better executed than the rude markings on the Wangen pottery, and yet they must in all probability be of much earlier date.—[Tr.]

found at Ebersberg, and in most of that from the tumuli of East Switzerland, which have incised line ornaments upon them, the lines are filled with chalk, which is set off more distinctly by the red or black colour of the ground.

Plate XIV. figs. 10 and 11 are two views of a flint arrow-head regularly serrated. Arrow-heads of this description, as well as those which are barbed, and, in fact, flint implements of any kind elaborately worked, though they abound in the north, are rareties in our district, where the raw material is scarce, and consequently the manufacture never came to any great perfection.

Fig. 13. Small bone implements made of the tarsal bones of dogs, sometimes found together by dozens in the lake dwellings; some are perforated at one end. They appear to have been amulets or personal ornaments.

Fig. 8. Portion of an implement furrowed and rather curved, made out of stag's horn.

Figs. 23 and 24. Fishing implements made of bone. These occur very abundantly. A straight pin or shank is cut away a little, or has an incision round it in the middle to which the fishing-line is attached, and then the little pin is quite covered over with the bait; when swallowed it cannot easily be got rid of by the fish. This plan is now in use on the Untersee for catching ducks.

Plate XXII. fig. 6. A fishing implement made of the branch of a shrub and its offshoot, and intended for drawing together and arranging the nets when dried. Exactly similar implements are now in use amongst fishermen.

Plate XIV. fig. 1. A piercing tool of bone, perforated.

Fig. 3. A wolf's grinder, perforated in the fang.

Fig. 7. Little stones of quite a common kind, with no work upon them except perforation. Stones like these are very abundant in the settlements of the lake of Constance, and also at Robenhausen.

Fig. 9. Ornament on a fragment of a roughly made urn-shaped earthenware vessel.

Plate XCIV. fig. 1. A peculiar ornament on pottery which is not rare at Wangen; it consists of a series of points or dots arranged in the form of a crescent. It occurs on similar vessels to those with the coarse kind of ornamentation drawn (Plate XIV. fig. 9), and appears like it to represent the half-moon.

Mr. Löhle has lately found a board of oak-wood, between seven and eight feet long, and a foot and a half broad, with a

corner rounded off on one side—apparently a bench to form a seat; and this view of it is rendered more probable by the fact that on one side (the upper one) it has been smoothed by being sat upon, and that it is the outer edge or corner that would correspond with this smoothed part, which has been rounded off. He has also found a round board of oak two and a half feet in diameter and about two and a half inches thick, with a hole running diagonally between the centre and the circumference. It has been taken for a shield, but this idea is probably inadmissible.

Some small celts of jadeite* have also been found, which is a kind of stone of a greenish colour, surpassing even the genuine nephrite in hardness, as it cannot be scratched by the hardest English file. This is the very hardest stone, which was ground down by the lake dwellers, for the flint and rock crystal were brought to the required form by blows from a hammer.

A fact which may throw some light on the food of the colonists is that Mr. Löhle finds in several places at Wangen beds of a brownish material, an inch thick and several feet wide, chiefly composed of apple-cores. The fact of such a quantity of remains of the apple being found together shows that the harsh wild crab was then as commonly eaten as the cultivated fruit is at present with us. Part of the brown substance arises from the undigested rinds of apples, and may indicate that the colonists were accustomed to make 'must,' or beverages from different kinds of fruit.

* See the note by Professor von Fellenberg on the analysis of nephrite, towards the close of the account of Robenhausen, page 56.

THE FASCINE STRUCTURE OF NIEDERWYL, NEAR FRAUENFELD.

This settlement, together with that of Wauwyl and a few others not yet thoroughly examined, show us that we may divide the lake dwellings into two classes; viz., what may be called pile dwellings, or those of the usual form, consisting of upright piles driven into the bed of the lake, and supporting a horizontal platform on which the huts were erected; and what may be called fascine structures (Faschinenbauten, Packwerkbauten, fascinage). In the dwellings of this kind the substructure does not consist of piles, but a mass of fagots laid parallel and crosswise one upon another, the lowest bed of which rests on the lake bottom. A layer of brushwood or of clay and gravel is spread between each of the beds of wooden material. The upright piles found in this mass of wood were not intended to support the superstructure, but to keep together the individual parts of the substructure; some of them also helped to form the walls of the huts and to support the roof. As at Wauwyl, they served chiefly as stays to prevent the structure from bulging horizontally. The fascine dwellings seem only to have been adopted in lakes of small depth and extent, and chiefly owe their origin to the fact that piles driven into the boggy beds of lakes of this kind would not have been able to bear the necessary weight: if heavily laden, they would have sunk down below the level of the water, or they would not have retained their proper position. It was impossible to adopt the fascine structure in the larger lakes; for it must have been foreseen that the waves, which could drive amongst the upright piles of the usual pile dwellings without injuring them, would in stormy weather wash over the edges of the fascine platform and tear it in pieces.

It is clear that the fascine dwellings were much more simple, and more easily erected than the pile dwellings, as they did not require any artificial means of joining the wood together. The commencement of the work seems to have offered the greatest difficulty.

For we find that there is a regular succession of different layers of fagot-sticks, brushwood, and gravel, down to the

bottom of the lake to a depth of twelve or fourteen feet, just as if the structure had been made on dry ground; and the question naturally arises, how it was possible under water thus to arrange these masses of wood so as to lie quite close and to lock into each other. The only conceivable mode of explaining it seems to be this: at the commencement of the work several piles were driven into the mud from a raft, from twelve to twenty feet apart, and then fagot-sticks were piled up between them horizontally one upon another, just as we find them arranged in the excavation; when loaded with a sufficient quantity of gravel, the whole mass of fascines must necessarily have sunk down to the bottom between the upright piles which served as guides or stays. In this manner a number of masses of wood were laid in the water one after another till the substructure had attained the desired height. Naturally the part above the water was more carefully executed. The upper beds of fascines in fact lock into one another at the ends, and form one continuous mass; and no large vertical gaps or chinks filled with clay, gravel, branches, or brushwood, are to be found here, like those which are very common when the lower part is exposed. This fact seems to confirm the above idea of the mode of construction.

It may be asked whether this fascine or fagot-work mode of structure indicates a higher antiquity on account of the greater simplicity of the substructure, and whether it may be considered as the original mode of erecting a habitation. But the manner in which some of the timbers belonging to the superstructure were worked and joined together by mortises and tenons, as well as the products of the potter's and other industrial arts, and more especially the successful prosecution of agriculture, which is here very evident, sufficiently prove that the degree of civilisation at the time of the fascine dwellings perfectly agrees with that of the other settlements of the stone period at Moosseedorf, Robenhausen, Wangen, &c.

Niederwyl differs from the allied structure of Wauwyl by the arrangement of the layers of wood above the water being very much more symmetrical, and also by the general use of split stems, and of actual boards two feet broad and two or three inches thick, the making of which must have been attended with much labour.

Niederwyl has thrown some new light on the nature of the huts. The floor of them consisted of layers of fagot-sticks or thin unpeeled stems two feet long, laid parallel to each other, the spaces between being carefully filled up with clay and rushes.

The interior was enclosed with boards standing on their edge, and forced in between the upright posts forming the supports of the walls. As in all lake dwellings, the space between the posts, three or four feet wide, was filled in with wattle-work and then coated with clay. The roof was formed of layers of straw and rushes. The dwellings, which were rectangular, stood tolerably regularly alongside of one another, and the space between them was two feet or at the most three feet. On the average they were twenty feet long and twelve feet broad. In the corner of one of them were found plates of sandstone used as hearthstones, which were covered with a heap of charcoal and ashes.

The layers of branches, gravel, ashes, and clay between the beds of fagot-sticks served to fill up the chinks or spaces, but not to keep the damp from the rooms above, for such light materials lying one above the other would have drawn the water upwards as by a sponge.

The abundance of corn (wheat and barley) and of animal remains shows that the inhabitants of this settlement lived chiefly by agriculture and keeping cattle, and that they carried on both to a considerable extent. As that part of the swampy lake left unoccupied by the dwelling itself was apparently not fed by any regular stream, but depended chiefly on rainwater, and perhaps some insignificant springs, fishing there could only have afforded the inhabitants a very small amount of sustenance, as the fish would be small and of inferior quality.

The use of flax was quite as general at Niederwyl as at Robenhausen. Several peculiar patterns of platted and woven work show the skill of the colonists in working this material; and if we may venture to judge from the number of fragments of both thick and thin cloth found in all parts of the dwelling, it seems reasonable to conclude that the inhabitants were not clothed in skins but in linen garments.

Another fact has been proved by the excavation, which is by no means unimportant:—No trace of burning is to be found in this settlement, so that it evidently was not destroyed by fire, but was voluntarily abandoned.

It seems probable that the dwelling of Niederwyl existed for some centuries, and that originally it was smaller and had not either its present height or extent. This supposition is confirmed by the following facts: hatchets and woven cloth were found in the lower beds; the stems of wood often lay quite sloping, so that in repairing the upper platform an even surface would have

to be adjusted by means of heaps of gravel; some masses of the wood were observed to be comparatively more recent; and burnt or charred places, marking the sites of former hearths, were met with in the beds lying under water; all of which clearly indicate a gradual depression of the whole mass of wood and the repairing of it by additions to the upper platforms.

It will readily be perceived that the fascine dwellings resemble in many respects both the Gallic fortifications described by Cæsar and also the Irish crannoges.

After these general remarks, it may be well now to give an account of the discovery of this singular settlement and of the excavations which have taken place.

Between the ancient Roman military road from Vitudurum (Winterthur) to Ad Fines (Pfyn) and the post road from Winterthur to Frauenfeld, there is an open place surrounded by low banks, in which is a small marsh or bog-lake formerly called Egelsee, the extent of which is about sixty acres: the greater part of it, in the course of centuries, has changed into a peat moor. It was formerly used as pasture land, but of late years it has been dug for peat; and as this operation was hindered by the water coming in from the rest of the marsh, the proprietors of the estate determined on cutting through the bank of earth which bounds the moor on the south side, and making a sluice, which, while it allowed the water to run from the peat diggings, might be dammed up in future to allow the new formation of this material.

There is one place in this moor where the workmen, at a depth of two or three feet, came upon a bed of clay, mixed with wood and all kinds of chips and rubbish, containing little or no combustible or peaty matter. It is about 100 feet distant from the eastern bank of the ancient lake, 300 feet from that of the south, and 200 feet from that to the north. It includes a space of about 20,000 square feet, and forms as it were an island in the ancient lake basin; for all round it the workmen found a depth of eight or ten feet of peat before they reached the bottom. This apparent island is what nobody had imagined, neither more nor less than the substructure of a lake dwelling.

We are indebted for the discovery to the Rev. Mr. Pupikofer. This gentleman, when examining the moor in June 1862, noticed, in a place bared of peat, parts of a fascine platform, together with fragments of stone hatchets, and a quantity of broken pottery. As he at once recognised in them the remains

of a lake dwelling, he communicated the facts to his brother, Dean Pupikofer, the president of the Historical Society of Thurgau, who lost no time in visiting this remarkable locality, and in publishing the discovery. The Historical Society of Thurgau then took up the matter, and entrusted to Mr. Messikomer, well known as the discoverer of the lake dwelling of Robenhausen, the care of an excavation to be made at their expense. The results were published by Dean Pupikofer in the second volume of the Communications of the Thurgau Society; and contain, besides his own introductory remarks, an account of the settlement, founded chiefly on the report of Mr. Messikomer, a description of the objects found, and an accurate plan of a small portion of the settlement, made by Mr. Hasenfratz.

The following is the substance of Mr. Messikomer's report:—

'As the water was considerably lower this year and the peat was drier, the labour of investigation was materially lightened. The labourers had often come upon stems of trees and upright piles, but nobody knew what to think of them till the substructure of the dwelling, and a number of burnt objects, such as wheat, barley, and bread, together with fragments of pottery, proved that the place was formerly a lake settlement.

'When I began the excavation with a few workmen on the 18th of June, I was surprised to find, under a pavement of clay and gravel, from two to four inches thick, and from the top of which three feet of peat had been removed, a structure of fagot-sticks regularly laid and perfectly solid; and as the wood was exceedingly soft, we had to use every care in uncovering as large a portion of it as we could. We first bared a space which was in perfect condition, twenty feet long, six feet wide at the ends, and ten feet wide in the middle. The upper platform was of split timber or boards of oak, laid down with great care, and it rested on round timber, or fagot-sticks, from three to four inches in diameter, which were surrounded with piles. The back part of this space was covered with charcoal, and was somewhat charred: there were also found tolerably large stones (hearthstones) in their original position. A most striking fact was that the lowest part of the side wall was still standing; it consisted of a kind of shutter pushed in between the upright piles surrounding the space. On this I had other portions uncovered, and everywhere met with the same construction, only differing in having the platform or floor made of fagot-sticks instead of boards. Here and there the floor had sunk considerably, often one or one inch and a half in six inches.

'This place was then left to be examined by the members of the associations of Thurgau and Zürich, and excavations were made in another place to examine the substructure. The result proved no less interesting; for one foot deep, under the first platform, we came upon a second; a foot deeper we found a third; then a fourth, and so on; so that the arrangement is similar to that of Wauwyl. The huts were placed on masses of wood, consisting of five or six platforms, one above the other, the spaces between which were filled in with brushwood and branches of trees, chiefly alder, rushes, gravel, and clay. We were surprised to meet with bones, cones of earthenware, and a great wooden mallet *between* the platforms; we also found woven cloth under the fifth platform and charcoal close to the bed of the lake. From this I conclude that the platforms were not made at the same time, but at intervals one after the other; or that they had been repaired, a portion at a time, as we found single charred stems under fresh wood.

'With a view to investigate the settlement in every direction, fresh excavations were commenced in a place where the peat had never been dug; so that by going carefully to work the uppermost platform might be seen in its original state. By the advice of Dr. Keller, a space of twenty-five feet square was marked out, and the peat carefully removed, and the sketch made by Mr. Hasenfratz shows the appearance and the mode of construction of the platform supporting the huts. (Plate XVI. figs. 1 and 3.) On this small space perfectly separate dwellings might be recognised, the size of which was indicated by the upright piles, often with the bark still remaining. In one case the regular fascine mode of erection was to be seen, in another a lattice or trellis work; so that we may conclude that these two buildings were used for different purposes.

'The plaster floor, which was three or four inches in thickness, doubtless served to keep out the damp. The fascine work had, as usual, sunk so much, that in order to restore the level a considerable quantity of gravel and clay had to be laid down: in one place the thickness of this plaster floor was more than a foot. What I have called the lattice or trellis work consisted of thin stems of trees, which were not laid close together, but at intervals of from one to two inches apart; the uppermost stems rested on others lying under them at right angles, and these again on others parallel with those of the upper layer. The spaces between the timbers were filled in with charcoal and burnt clay.

'The two dwellings which we excavated did not touch each

other, but stood about one and a half or two feet apart. In this space there was a row of upright piles, of which some were clearly intended to keep together the substructure and others to form the walls of the hut and to support the roof. The stems forming the trellis and those of the fascine erection overlapped one another. The fagot-sticks (Knittel) consisted either of young stems partially cut through in lengths of six feet, and then broken in two, or of older trunks felled in the same way by a cutting instrument, not by means of fire, and afterwards split.

'In the narrow space, only a few feet wide, between the two habitations we found broken stone hatchets, corn, burnt platwork of flax, &c.

'We cannot imagine that this settlement was destroyed by fire, for although we occasionally met with burnt beans, not a single trace of conflagration was to be seen in the upright piles, which projected as much as two feet and a half above the floor—nay, even in most of them the bark was still in good preservation.

'The products of the potter's art were in general very coarse, and yet we found a few fragments which had been ornamented, and also parts of the rims of vessels made with washed or purified clay and without quartz-grains. Fragments of vessels also were found neatly polished, blackened and with handles of a convenient form. No smaller implements were met with, such as pins, little chisels, &c. It is very singular that so few bones were found: the cow, the stag, and the pig were the only animals the remains of which were discovered here.

'At the bottom of some broken earthenware vessels there still remained grains of wheat and barley and hazel-nuts: doubtless all the food, whether animal or vegetable, was kept in large or small vessels of earthenware.'

Amongst the objects found at Niederwyl was an oak mallet, fourteen inches long, which evidently had been worked by stone hatchets, and clearly had been used for driving in the piles. (Plate XVI. fig. 7.) A similar mallet is in the collection of Colonel Schwab.

Plate XVI. fig. 5. A beam with mortise poles.

Plate XVI. fig. 6. A cone of baked clay, perforated towards the top. Several specimens of this kind of implement, both larger and smaller in size, were found here; they were used as weights for stretching the warp in weaving.

Plate XVI. fig. 4. The upper end of a pile, with a hollow cut in it for the reception of a cross-beam. Similar piles are found

at Castione (see Plate LX. fig. 2), at Robenhausen (Plate XIII. fig. 7), and in other lake dwellings.

Plate XII. fig. 1 is the sketch of a large implement, if it may be so called, made either of elm or ash-wood, and hewn with stone celts or knives. Both sides are alike. There are several places in the side arms where apparently the wood was cut thinner. It would be useless to mention the different opinions respecting this very problematical specimen, for none of them seem to be of any value.

To complete our knowledge of this singular settlement, we will now refer to two sketches, which probably will give a more vivid idea of the place than the actual ground plan.

Plate XVII. is the sketch of a small part of the lake dwelling from a photographic view taken in 1862. In the middle may be seen a sandstone plate belonging to the hearth, lying upon a flooring of clay and gravel. To the right of this there are two rows of pile-stumps running diagonally through the picture towards the shovel; these piles mark the outer walls of two houses, and consequently the space or passage between two rows of huts. Still more to the right may be seen another flooring, on which a hearth was also found. It should be mentioned that the hollows between the stems of trees were originally filled in with clay, but that the water with which this platform has been covered for thousands of years has softened and washed it away. Unfortunately, this view was not taken till a large number of the pile-stumps had been destroyed, as they were exceedingly rotten, so that neither the exact size nor the divisions of the huts could be ascertained with certainty.

The second sketch (by the translator) is of less importance, as it was not taken till the summer of 1864, after the settlement had been exposed some time, and of course had been considerably injured by the summer sun and the winter frost; still, to those who have never seen a fascine structure it may give some idea of its appearance. The first impression probably would be that the stems had been as it were woven together, and that it was neither more nor less than a huge floor of wattle-work: this, however, is not the case; the appearance entirely arises from the soft or rotten state of the sticks, some parts of which, as they cross one another at right angles, must necessarily have projected more than others, and, being more exposed to the wearing influence of the weather, have decayed away, leaving those portions in the hollows more perfect, and thus giving the appearance of wattle-work above referred to.

LAKE OF WAUWYL.

We are indebted for our knowledge of this settlement to the care of the proprietor, Colonel Suter of Zofingen; the investigation of it was carried on under his direction and at his expense. This little reedy or 'moor lake' is situated in a wide open valley of the canton of Lucerne, not far from the small town of Sursee, and in earlier times must have been of considerable extent. About eight years ago it was nearly laid dry by artificial drainage, and three years after, when the labourers began to cut the peat, they came upon a kind of wooden stage of considerable extent, on which a great amount of labour had been spent, and which had been covered over with peat apparently for centuries.

This settlement, which belongs to the earliest or stone period, agrees in many respects with that of Niederwyl, but probably approaches quite as nearly in structure to some of the Irish crannoges described by Sir W. R. Wilde. Like them, it is built up of many layers of trunks or stems, arranged crosswise in all directions one over the other: this mass of wood was placed on the bed of the lake, fixed there, and so made a firm and immovable foundation. It is further remarkable that the platform has been preserved under the sheltering cover of the peat, and that within the area a certain kind of arrangement may be noticed, from the position of the piles betokening the property of different families.

The following is the substance of the report given by Mr. Suter, the son-in-law of Colonel Suter:—

'The whole structure consists of vertical piles driven more or less deeply into the lake bottom, and of horizontal trunks or stems lying one over the other between these piles, in various directions, sometimes at acute but chiefly at right angles to each other. These horizontal stems form platforms, of which there are as many as five laid one over the other. (A sketch of these five platforms, taken by Mr. Nager from an actual measured space of ten feet square, is given in Plate XIX., the left side, and a section, in Plate XIX. fig. 4.) The lowest rests on the bed of the lake; the thickness of all of

them together is now about three feet. There are no heads of piles on the surface of the lake bottom which might have supported the horizontal beams of the lowest platform; in fact, in the whole space which was excavated not a single vertical pile was found which had been used as a support for any horizontal timber. Two different platform systems are often in a measure bound together by many of the stems of the uppermost platform of one system projecting into the second of another system, and so form a kind of passage-like connection rising up in the form of steps, which probably may be about four feet broad. The whole of the timber consists of unhewn round stems. No incisions or notches are found on any of the upright piles, and in the horizontal round stems there are no parts flattened or cut away, nor is there any other mode of binding the wood together which would require anything but the most simple tools. Not a single hole is to be observed in any of the timbers, and a wooden nail or spike has never been noticed. The horizontal stems are merely placed close to each other, as shown Plate XIX. fig. 5; and at the points where some of them cross each other, and which may be considered as the frame of the platform, there are upright piles between which the stems forming the frame have probably been thrust. In some places one might be led to think that these stems could easily have been moved backwards and forwards between the upright piles. These vertical piles everywhere project at least a foot above the uppermost platform.

The interspaces or joints between all the horizontal stems are filled in with clay, and underneath, that is between the platforms, there are all kinds of branches and brushwood mixed also with clay.

Occasionally some of the upright piles might be observed, the upper end of which had been sharpened into a point by fire.

On the area excavated up to the present time a space about ninety feet long by fifty broad may be pretty clearly seen, which appears to have been covered with platforms of different heights. Around this rectilinear space, which perhaps may be considered as the substructure of the houses of one family, there are groups or bands of upright piles four or five feet broad and often broader, driven in quite irregularly and without any horizontal stems lying between them.

These bands of independent piles project almost in every direction beyond the corners of the rectangle, and in the direction of the sides, as is shown Plate XVIII. fig. 3, and this

fact seems certainly to indicate the existence of other similar platforms being near—a supposition which is borne out by the fact that exactly similar structures are found less than a hundred feet from the rectangle just described, and also in a south-easterly direction on the moor road from the lake of Wauwyl. Similar traces are also found in several places in the neighbourhood, which indicate a very extensive settlement, and which are marked on the plan of the district (Plate XVIII.) made by Mr. Nager, the civil engineer.

Let us now for a moment examine the use of the upright piles which stand independent or apart from the regular structure. They may have served either, first, as fixed stays to secure the structure from bulging in a horizontal direction; or they may, secondly, have been useful as defences against hostile attacks; or, lastly, they may have served as supports for passages or stages from one structure to another: some of these passages have actually been found.

Plate XVIII. will probably give a clearer idea of the locality and of the mode in which both the upright piles and the horizontal timbers were placed. Fig. 1 gives a section of a part of the Wauwyl lake.* The expression 'Weisser Grund,' or shell-marl, means, as is well known, a bed of white chalky substance consisting of innumerable snail-shells, all disintegrated and become a fine powder; it is found in all the moor lakes of Switzerland, and is from one and a half to two feet thick; in some places it is even four or five feet in thickness. Beneath this bed is sand, and below this is 'Grien,' or gravel, or sandstone. At the age of the lake dwellings the peat which afterwards grew up and buried the remains of the burnt settlement a fathom deep did not exist, or if it did, it was only to a very small extent, for all the antiquities discovered here lay immediately upon the shell-marl. But here, as was the case with several other settlements in the moor lakes, the peat began to increase very soon after the colony was founded.

In order to see how deep the upright piles went into the lake bottom, two of them were pulled up: the longer one went through about four feet of peat and about eleven feet into the lake bottom; on the other hand, the shorter one passed through four feet of peat and only went four feet nine inches into the lake bottom (Plate XVIII. fig. 2). As the excavation was made in a locality where peat had formerly been dug, it is to be

* This section would have been made more intelligible if instead of the word 'Piles,' the words 'Piles and horizontal timber' had been substituted.—[Tr.]

presumed that the piles were formerly much higher in the peat. The thickness of the peat here was five feet ten inches. The lower ends of the two piles pulled up show that very imperfect instruments were used, for they are rather bluntly wedge-shaped than pointed (Plate XIX. fig. 6). In general, the upright piles are three, three and a half, four, and four and a half inches thick.

It may be well to remark here, that no implements or animal remains were found under the horizontal platforms, but by far the larger proportion in the enclosure which has been described, or on the outside of it. This fact confirms the supposition that the dwellings stood in water, that is, that they were surrounded by water the whole year, for the inhabitants, however little they may have cared for such things, would not have thrown the animal remains in the immediate neighbourhood of their abodes had it been dry, on account of the bad effluvium which would have been the result.

Before the lake of Wauwyl was drained and excavated, the surface of the water often rose to the level of the upper bed of peat in the place where the settlement was discovered, and a piece of neighbouring moor land of some extent, called the Zitteri, could not be passed over without causing a tremulous motion: the peat was, in fact, nearly saturated with water up to the surface. If we bear this in mind, and also what has before been mentioned, viz., that probably no traces of peat existed at the time of the lake dwelling, it follows with tolerable certainty that at that period the lake was here four or five feet deep. If, therefore, the structures were permanently placed in water, the question next arises, were they floating, that is, fixed rafts? or were they motionless? that is, did they stand firmly on the lake bottom?

There appear to be grounds for both opinions. For the first supposition, namely, that the entire mass was a fixed raft or float, the following reasons may be given:—

1. There have never been found any piles driven into the lake bottom under the lowest platform which might have served as supports for it.

2. The five platforms lying one above the other in the excavation of ten feet square were, as above mentioned, altogether only three feet in thickness, and therefore it is not probable that these five platforms filled the whole space between the surface of the water and the bottom of the lake; in addition to which it seems pretty certain that all the platforms were not

constructed at the same time, but that a new one was added above as it was wanted.

3. The step-like joining of the unconformable platforms (to use a geological term) of the different systems, as described, does not contradict the idea of a fixed float, for they are so constructed as to allow a rise and fall in the water-level.

If the idea of a fixed raft be considered probable, then the upright piles were intended to serve in a vertical direction as stays or guides for the horizontal platform.

The following are the arguments in favour of the view that one platform lay upon another from the bed of the lake upwards :—

1. As the lowest horizontal platform lies immediately on the lake bottom, and there is a layer of all kinds of brushwood and clay between each bed, the five platforms may originally have been considerably more than three feet thick, and thus may have reached above the level of the water, and they may in later times have been compressed to their present thickness by the mass of peat above them. As a proof that very great changes have taken place in the lowest part of this structure, the fact may be mentioned that when the lowest stage was examined (see Plate XIX.), which was done with great difficulty, the horizontal stems could not be clearly distinguished, nor could the upright stems be here recognised at all, though they were quite well preserved in the higher platform.

2. The vertical piles are in many cases joined in such a manner with the horizontal ones that the conclusion seems imperative that the latter were jammed in between the upright ones —a fact which would indicate fixed, not movable, platforms.

3. No traces of anything like wooden bands were found joining one horizontal platform with the others, which probably would have been the case in an actual floating raft.

With respect to the mode in which the vertical and horizontal timbers were joined, it may be well here to mention that in the sketches elucidating the structure it might appear as if the horizontal stems were pierced through in many places by the upright ones ; but this is never the case. The horizontal stems are either pushed closely up to the upright piles (Fig. 2, Plate XIX.), or they are squeezed between two upright ones, and the apparent piercing of the horizontal stems is neither more nor less than a consequence of the lateral compression of the softened wood. (Fig. 3, Plate XIX.)

In the course of the excavation it occasionally happened that wood was met with apparently in the shape of boards, but a

careful examination showed that they were only round stems, placed one above the other, and compressed. In fact, through the whole structure no boards were found, but only round stems. In one case a piece of timber some fathoms long projected probably a foot above the level of the uppermost platform, and had every appearance of a thick board placed on its edge, but on examination it proved to be only a round stem, the convex surface of which, being soft, had been shovelled away by the workmen (Plate XIX. fig. 1), and it proved to be the uppermost piece of many other round trunks placed one above the other, the spaces between them being filled in with extraneous material. It is not improbable that the long stems which had the appearance of boards, but afterwards proved to be a combination of many stems laid one upon another, and pressed together, may have formed the lowest part of the side-walls of rectilinear huts, thus differing from the huts of wattle-work and clay in other lake dwellings, and, like the log-huts or granaries of the Alpine districts, being built of trunks of trees.

All the vertical piles project considerably above the uppermost horizontal platform, and in earlier times may have been still higher, so that they may with great probability be considered as portions of the walls of the huts and supports for the roof; they are almost always arranged at right angles, so that it seems certain that the ground plan of the dwellings was in the form of a rectangle, a figure which would be erected much more easily, and which would better agree with the arrangement of the round stems forming the platforms: none of the piles are found placed in a circular form. The restored or ideal sketch at the top of Plate XX. shows the probable division of the particular houses according to this view, though in one respect it may not be quite correct, for from late discoveries some at least of the houses stood much nearer together than they are here represented.

A considerable quantity of charcoal from round or unhewn timber is found amongst the ruins, but no remains of the burnt clay covering of the walls with impressions of wattle-work, such as is frequently found in other lake dwellings which have been burnt.

The kinds of wood used in this structure were oak, alder, and fir. The dimensions of the horizontal stems varied: those of oak were the thickest, and measured five inches in diameter, or even more, while the other sorts were only three or four

inches thick. It is a singular fact that the oak-wood showed less solidity than the fir or alder: all the stems had the bark on; it was preserved entire on those of alder.

Some of the antiquities found at Wauwyl are drawn on Plate XX.

Fig. 1 is the sketch of a long pebble, probably used for stirring up the melted asphalt.

Fig. 2. Celt of serpentine set in a stag's horn hafting. Several other celts both of quartz and serpentine were also found.

Fig. 3. Bowl made of yew-wood.

Figs. 4 and 12. Fragments of pottery; the outside is partly covered over with asphalt, and the inside coated thickly with soot. The material of this pottery is unwashed clay mixed with a large proportion of quartz-grains. Earthenware vessels, or rather, unfortunately, the fragments of them, were very abundant: hardly any were obtained perfect.

Fig. 5. A roundish stone of coarse-grained sandstone, similar to those found in other lake dwellings.

Fig. 6. A piece of sandstone with the hollow caused by stone celts having been ground down upon it; several varieties of these grinding-stones were met with.

Fig. 7. A glass bead of a bluish-white colour when the light falls upon it, but of a honey-yellow when held between the light and the eye. The bluish colour of the glass arises from the mixture of lead. This bead, though apparently unimportant in itself, is of great interest from having been found in this locality: it may probably throw some light on the date of this settlement, which was founded, and, as it appears, also came to an end, in the period known in the history of civilisation as the stone age. This small ornament, in fact, affords indubitable proof that the inhabitants had intercourse with the civilised nations on the coast of the Mediterranean, who had made great advances in the arts, while they themselves were in the lowest stage of development. This glass bead is quite similar in form and colour to those found in the graves of the earliest inhabitants both in Egypt and in nearly all the western countries, and which have also been met with in great numbers in Roman settlements. These glass objects of the earliest times may either be of Egyptian or of Phœnician origin, for in both countries glass manufacture was carried on, in the former more anciently, and in the latter less so; but it is improbable that these productions came into Europe in any other way than by means of the Phœnicians, for there can be no doubt

that in a similar way they were the first who brought the tin of Britain into the commerce of the world, and who taught the inhabitants of southern and western Europe the use of bronze which had already been used in ancient Egypt for the preparation of tools.* Just as the fact of finding in all the lake dwellings and in the oldest Celtic tumuli and graves, tools of noble nephrite, a kind of stone universally allowed by mineralogists to belong only to the East, gives us a proof of barter in the earliest times between Europe and farther Asia, so, as history affords us some information as to the origin and continuance of the Phœnician trade, this glass ornament gives us a chronological datum for determining the age of the lake dwellings, which, however insufficient it may be, yet expressly forbids us to throw back their existence to a period many thousand years before our era.

Fig. 8. A lump of asphalt which was used for fastening celts, arrow-heads, saws, &c.

Fig. 9. Knife made of yew-wood.

Fig. 10. Awl or piercing tool made of stag's horn.

Fig. 11. Saw made out of the bone of a small quadruped.

Fig. 13. Bead made of stag's horn.

Figs. 14 and 15. Fishing implements (floats?) made of wood or bark.

Fig. 16. Cutting instrument made of a boar's tusk.

Fig. 17. Flint knife of the usual form and size.

Figs. 18, 19, 20. Chisel-shaped implements made of the long bones of quadrupeds.

Figs. 21, 22, 23, 24, 25. Piercers or tools made of sharpened portions of the long bones of small animals.

Fig. 26. A barbed dart or harpoon made of stag's horn.

Recent excavations at Wauwyl by Colonel Suter of Zofingen have produced several objects of interest, and also some additional information. The following notices of the additions made to the Colonel's collection have been kindly sent by his son-in-law, Mr. Suter.

Amongst the animal remains lately found are the skull of the marsh pig and the bones of the bear (*Ursus Arctos*). A large

* Amongst the sepulchral paintings of Beni Hassan, which, according to Sir Gardner Wilkinson, are 3,500 years old, is a representation of glass-blowing. The manufacture of glass beads is also drawn—one workman lays hold of the beads which are in the basket on his knees, while another workman bores holes through them with a drill.

number of stone implements have been met with, the most interesting of which is a celt of nephrite, the largest I have seen, for although broken, it is three inches long and fully two inches wide. Amongst the implements of bone there are some tools hitherto unknown; they are made of pieces of stag's ribs from eight to eleven inches long, one-half of which is in its natural state, or is only a little ground down at the edges; the other part is sharpened at the end, and has a deep incision in the middle, down to a third or nearly one-half the length, so as to give the appearance of a two-pronged fork. In all the specimens found, of which half-a-dozen have been met with at Wauwyl, and several exactly similar at Robenhausen, the prongs or teeth, both inside and out, have been perfectly made smooth, apparently from long use, while the other end is left in the rough. The fact that two or more of these things are always found together, as well as their form, leads to the supposition that they may have had something to do with the preparation of flax, and may have been used as heckles. Some of them are drawn (Figs. 8, 9, 10, and 11, Plate XXII.).

Amongst the objects made of horn, the hafting of a stone celt is worthy of notice: it is drawn Plate XXII. fig. 7. Amongst those of wood may be mentioned that drawn Fig. 12, which is also a hafting or club for a celt. Figs. 17 and 18 are ornaments or implements of stag's horn.

A fresh excavation has been made by Colonel Suter in the peat moor near No. 5 in the plan on Plate XVIII., about fifty feet long by thirty feet broad, and Mr. Nager, the civil engineer, has kindly sent me drawings of the different layers of wood and sections of the excavations. But as the construction is precisely the same as that previously described, it will be needless to repeat the particulars; some of the notices, however, sent by Mr. Nager are of considerable interest, amongst which is the following:—

'In the place excavated in the year 1864, platforms of round timber were found everywhere with some piles driven in vertically. Upon these layers might be seen, at a distance of ten or twelve feet apart, three hearths made of unworked or rough stones of different sizes joined together with clay and sand, and arranged in the form of a half-moon. Charcoal-ashes and charred wood were found within them. Even the substructure, that is to say, the platform of round wood, was charred and had been covered with sand and clay. Near these hearths the platform had sunk in some degree, probably from the weight of the

people who sat around the fire and worked there, and also of the raw material heaped up here for making stone implements. For, close by, there was found a surprising quantity of flint refuse, as if it had been a regular workshop of this material. Half-worked and broken arrow-heads, as well as those which were quite perfect, and flint knives of various sizes, from 1½ inch to 4 inches in length, were lying on the surface, as well as pottery and stone celts, both solid and perforated; amongst the latter there was one which had in it the handle of ash-wood still remaining.

'Wherever excavations have been made in the moor in any part of the widely extended lake-dwelling area, no actual pile erections have been found, but only the fascine structures, exactly like that of Niederwyl. It may, however, be remarked, that at Wauwyl there is great irregularity in the position of the individual logs of the same layer, as well as of the layers with respect to each other. It appears as if various deviations from a parallel arrangement of the logs had arisen, sometimes from fancy and sometimes from convenience and the thickness of the logs. The platform in the place last excavated rests upon peat; in fact it appears as if the whole structure was placed upon it. It is, however, possible that when the settlement was founded the peat which was at that time accessible may have been used as a material for the foundation in order to save timber. The weight of the earth placed on the platforms has pressed down the trunks so much into one another as almost to give the appearance of their having been artificially joined. But hitherto I have not noticed in the lake dwellings of Wauwyl any artificial joining, not even the most common carpenter's arrangements, such as those which are called "mortise and tenon" and "notching."'

ALLENSBACH AND MARKELFINGEN, ON THE UNTERSEE.

It appears from late observations that nearly the whole shore of that portion of the lake of Constance called the Untersee is studded with the remains of lake dwellings; and judging from the implements hitherto obtained there, they belonged exclusively to the stone period. It is also remarkable that there are no traces of conflagration, so that the inhabitants appear of their own free will to have abandoned their dwellings on the lake, and to have settled on land before any kind of metals had been brought into use by commerce or barter.

A catalogue of all the known localities of lake dwellings in this part of the lake will be given in the geographical list, but the settlements in the neighbourhood of Allensbach and Markelfingen have been so carefully examined by Mr. Dehoff, that they require a separate notice, and we cannot do better than transcribe almost entire the account which he has given respecting them.

There are three lake dwellings in this neighbourhood worthy of notice.

1. A settlement above Markelfingen.

2. One about half-way between Allensbach and Markelfingen, adjoining the landmark of Reichenau.

3. A third reaching from above the mouth of the mill-stream at Allensbach up to Weiler Hegne.

All of these were examined as carefully as possible, and will now be described in detail, together with the antiquities, so far as they are of interest.

1. The settlement above Markelfingen is situated around a little island about thirty paces in diameter and more than twenty minutes' walk from the village of Markelfingen. This island is about thirty paces from the shore in a north-westerly direction, and when the water is low is about half a foot above the surface, but when the water is higher it is entirely covered about a foot deep. The piles surround this little island on the west and north-west sides, not in any considerable number, but still

tolerably plentiful, as was seen at the lowest level of the water in the winter of 1862, when they were covered with a depth of more than three feet of water. There are no remains of piles on the island itself, but a rather large number of stone celts roughly made out of the rolled stones found on the bank were found there.

2. The lake dwelling above the one last described and below Allensbach, adjoining the landmark of Reichenau, is situated on a tongue of land, and stretches from east to west, with a tendency to north-west, for a length of about 1,000 paces. Probably for about a quarter of this distance the side of the settlement next to the shore was accessible dryshod; the rest of the piles stretch some distance into the lake. The little plan made at my suggestion by the Grand Ducal Board of Works in the interest of archæology indicates the arrangement of the piles. (Plate XXIII. fig. 1.) It may, however, be assumed with certainty that at least an equal number have been destroyed or carried away by the violence of the western storms, and probably many have been covered either by mud or the deposit from the stream, or by the gravel and rolled stones piled over them.

It is quite impossible, from the remains still existing, to lay down with certainty a definite ground plan of the dwellings, and the arrangement of the piles gives us no positive information as to the number of huts which once existed here; still it is very evident that the settlement was of considerable extent.

In one place the rows of piles take the direction of the mainland in such a manner, that they may with tolerable certainty be considered as the remains of the ancient entrance stage or bridge.

With respect to the kinds of wood used for the piles, amongst those which have been examined the softer descriptions, such as white and red fir and the willow, were found to predominate. The piles made of these kinds of wood were all whole or round stems, while some of oak were made of split trunks originally fourteen or sixteen inches in diameter. The piles only project about one or two inches above the bed of the lake; there was, however, one single round oak pile rising two feet higher than any of the others, the heart of which, about an inch in diameter and fan-shaped though split, was in perfect preservation.

The plan shows at *a* the place where some beams lie in a

horizontal position amongst the piles. I consider them as parts of the ancient superstructure. Some specimens which have been brought up show very clearly the structure of oak-wood; they appear to have been made of split trunks. These horizontal beams are fifteen feet long and from four to six inches in diameter: the place where they occur, even at the lowest level this year, was covered with two feet of water, so that further investigations were impossible for the present.

The nature of the ground throughout the settlement was as follows. First, the usual covering of a deposit of gravel about two inches thick or rather more, under which was the 'relic-bed' from half an inch to 1½ inch in thickness, below which were many feet of the well-known shell-marl (blanc fond). In the north-western part of its area, as also in the places farthest in the lake, the covering of gravel on the bottom was entirely wanting, and a 'relic-bed,' two inches thick or rather more, and almost like mud, rested immediately on the white sand.

The unfavourable influences mentioned above have either carried away or broken up the lighter remains, such as those of wood, horn, or bone. Some remains of enamel from the teeth of large mammalia seem to show that they had been rolled into fragments.

The heavier stone implements were consequently the only evidences of civilisation discovered. By far the greater number of them consist here, as elsewhere, of stone celts, varying most exceedingly both in size and form, and thus leading to the conclusion that they had been used for many different purposes. They vary from less than an inch to 21 inches in length, and from 5 lines to 3½ inches in the breadth of the cutting edge. Some, especially the larger ones, run somewhat to a point at the end opposite to the cutting edge, and near this end the stone has no doubt intentionally been made rough; evidently the tools of this description had been set in pieces of wood, horn, or bone, hollowed out to receive the celt: probably they were used in agriculture. By far the greater proportion of specimens of this kind have been worn much more on one side than the other, which seems to indicate this application of them. The other sort, with generally a broader and less curved edge, tapers less at the opposite end, appears more fitted for being held in the hand as a cutting tool, and shows the wearing of the edge more in the middle (pieces having flown

off), while the first kind may be distinguished by being nearly blunted on one side.

Corn-crushers were found in great numbers, and also some flint saw-flakes without handles.

The rolled stones lying about close by evidently had afforded the material for the greater part of the celts; a small number of specimens, however, were met with made of serpentine.

Besides the celts just mentioned a specimen was found, drawn in two positions (Plate XXIV. figs. 10 and 11), which I take to be the front half of a battle-axe. It is of black serpentine from the Grisons; its length from *a* to *b* is 3 inches 3 lines; its greatest breadth from *c* to *d* is 2 inches 4 lines; the width of the haft-hole, which is made of a conical form, is nearly an inch in one direction and 10 lines in the other. This specimen has been worked with the greatest care both as to the exactness of the dimensions on both sides, if measured with the callipers, and also as to the mechanical finish, evidently produced by grinding. One in some measure approaching to it is drawn Figs. 6 and 7.

Another specimen, new of its kind, is drawn Plate XXIII. figs. 3 and 4. The material seems to be Alpine limestone; probably the implement was made out of a rolled stone. The drawing will give the best idea of its form: the length from *a* to *b* is 3 inches 5 lines; the breadth from *c* to *d* is 2 inches 7 lines; the height or thickness from *e* to *f* is 2 inches 4 lines; and the height of the handle worked out is 4 lines. This implement, from its general appearance, seems to have been used as a crushing instrument, and yet it evidently has not been rubbed, like the specimens known as corn-crushers, on another stone, but on some softer substance, perhaps made of wood, for there are no traces of wearing on its under side. If it is allowable to hazard a conjecture, I would consider this specimen, taking into account the large quantity of raspberry-seeds found in the neighbouring settlements, as an implement for crushing fruits of this description in order to procure the juice.

Plate XXIV. figs. 8 and 9 give two views of an object the use of which also is very doubtful, and respecting which I will not venture to offer an hypothesis. It also is made of Alpine limestone; the length is 3 inches 7 lines; the breadth 2 inches 4 lines; the thickness, including the raised part, 1 inch 5 lines; the elevation itself 2¼ lines. The upper surface, with the exception of the back or hinder part, which shows the natural

fracture, is carefully worked, and in a similar state to the hinder part of those celts which have been intentionally made rough. The rise in the middle, which has evidently been artificially worked out, is only a little smoother than the rest of the upper surface.

The use of the implement drawn Plate XXIV. figs. 2 and 3 is no less doubtful. The material is diorite. The upper surface is more carefully worked, and smoother than that of the specimen last described; it appears to have been ground. The length from *a* to *b* is 5 inches 1 line; the greatest breadth, from *c* to *d*, is nearly 2 inches. The thickness, including the ridge, is nearly an inch, and the height of the ridge itself is nearly a line.

Plate XXV. fig. 1 is the sketch of a stone intended for a hammer; it is, however, only half perforated; the section (Fig. 7) will give some idea as to how this operation was performed.

Plate XXV. figs. 15, 16, and 18. This specimen appears to be an unfinished hammer made of serpentine: the under surface and the sides half way up have been ground, while the other part of the sides and the upper surface is worked entirely in the rough. The letters *f*, *d*, *a*, show the ground under surface; *e d* the portion of the side which has been ground, and *e c* what has been left unworked. Towards the front from *d* to *a* the under surface is sloped outwards in the form of a skate. The length is 5 inches 1 line; the greatest breadth from *g* to *h* is 2 inches 8 lines; the smallest breadth from *i* to *k* is 2 inches, and the thickness from *c* to *d* 2 inches 1 line.

Plate XXV. figs. 9 and 10 is probably a corn-crusher, but of a somewhat peculiar form; it is particularly remarkable for having the two side surfaces rubbed quite smooth. The length is 3 inches 4 lines; the greatest breadth from *f* to *e* is 2 inches 4 lines; the smallest, from *g* to *h*, is about 2 inches. It is remarkable that not only the part *c d*, but also both the slopes *a c* and *d b*, still bear unmistakable traces of rubbing down, by which regular sharp ridges have been made at *g*, *a*, *h*, and *f*, *b*, *e*.

The specimen drawn (Plate XXV. figs. 2, 3, and 8) is also one the object and use of which must remain conjectural. It is not easy to decide as to the material, for it is covered with a coating of a muddy chalky substance, which cannot be removed without damaging the specimen, but it appears to be sandstone. The length is more than 5 inches; the greatest breadth from *c* to *d* is 2 inches 5 lines; the greatest thickness from *e* to *f* rather more than an inch; the thickness in front is $4\frac{1}{4}$ lines. The work-

manship is throughout of the best description, and the specimen appears to have been ground all over.

The stone celt drawn (Plate XXV. figs. 11 and 12) is of a peculiar form. The cutting edge is sloped or curved down on the lower side, and at the hinder end there are on both surfaces corresponding circular depressions cut out more than 8 lines deep, and these, together with the peculiar form of the edge, make the specimen appear like an axe. The length on the upper side from *b* to *c* is 5 inches. On the under side from *a* to *d* is 4 inches 2 lines, the diameter of the base from *f* to *g* is very nearly an inch, and the diameter of the upper surface 1 inch 6 lines. The material cannot be determined with certainty, on account of the thick coating of chalky substance, and yet from its greenish-grey colour and the fineness of the grain which may be seen in some places it probably may be serpentine.

The lake dwelling in the north-west bay close by Allensbach has yielded no small number of stone celts, but all entirely coated with chalky mud, and also a hammer like that drawn in Plate XXXIX. fig. 5. The boring of the haft-hole is not finished, but is only carried to a depth of 1 inch 8 lines; the diameter of the hole is 8½ lines, and at the bottom the central portion projects about 4 lines high. Besides this one, three unfinished specimens of similar forms were found here, partly ground and partly only worked out of the rough.

3. From a little above the place where the mill-stream of Allensbach falls into the lake up to a point below Weiler Hegne, and consequently in an easterly direction from that just described, a very large lake dwelling extends nearly half-an-hour's walk in length, the whole distance being clearly marked either by actual piles or by the discovery of stone implements. The piles begin about 300 paces above the last houses of Allensbach at first only to be recognised in a single row, afterwards two rows are seen, and lastly, in a place which goes by the name of 'beim Eichle,' on a gently sloping shore, an extensive settlement appears covered with a number of piles in four and sometimes in five very distinct rows.

The single row runs close to the land, the other thirty paces out in the lake and parallel with the shore. The shape of the dwellings erected on this area, according to the arrangement of the piles, has doubtless been a quadrangle. The place is for the most part only covered with water when it is at its highest level, but at all times of the year the approach to it from the mainland must have been practicable almost without any scaffolding

or stage. The land immediately adjoining to it, now made into meadow, was a forest not very many years ago. Bearing this in mind, there could hardly be found a more secluded place for a settlement than this locality, lying in a bay sheltered on both sides by the projecting forest and probably only visible on the side of the lake.

The upper surface of the lake bottom towards the mainland has a thick covering of gravel, under which there is a considerable bed of white sand. Most of the antiquities are found at a depth of one or two inches, but the pottery afterwards to be noticed is found deeper, and as much as five inches under the surface. A 'relic-bed' can only be seen in some places, and more especially in those which are situated at a higher level; in the lower parts the covering of gravel rests immediately on the shell-marl.

The antiquities found here consist chiefly of stone celts, the majority of which exhibit workmanship indicating an extraordinary degree of skill. Some few, especially the smaller specimens, are not only ground on the whole upper surface, but seem regularly polished, and might fairly pass as ornaments or objects of the toilet-table. Plate XXV. fig. 4 gives the form of a specimen finished in this manner. The material is said to be diorite. The length is 2 inches 4 lines; the breadth at the cutting edge 1 inch 7 lines; the breadth at the hinder end is $4\frac{1}{4}$ lines, and the thickness in the middle is also $4\frac{1}{4}$ lines.

Besides these there were found here very beautiful saws of yellow flint, and also the lance-point of black flint drawn Plate XXIII. fig. 6. This specimen is $2\frac{3}{4}$ inches long; its greatest breadth 1 inch 2 lines, and the thickness at the lower end $2\frac{3}{4}$ lines.

As fragments of charcoal and broken pottery were here lying scattered about on the surface, it was deemed advisable to excavate, and within the area of a few paces three earthen vessels were discovered. They were all of the most primitive form, only about four inches and a half high, and a little bulged; they had no handles, but holes had been roughly bored at the upper edge, through which cords might be passed. They were mostly so weathered and rotten, that notwithstanding the greatest care they could only be taken out in pieces. The material is a mixture of clay and loam, to which grains of coarsely powdered quartz are added. It may be seen at a glance that these vessels were made by the hand alone, and show no trace of any skill in workmanship: the sides were from $4\frac{1}{4}$ to $8\frac{1}{2}$ lines thick. One

of these vessels which had a thick coating of soot in the inside was filled with a grey mass like ashes mixed with pieces of charcoal, in which there was a very friable great bone of one of the extremities of an animal. A second vessel, also coated inside with soot, contains a brownish mass of earth, the nature of which is now under examination by Mr. Leiner of Constance. The third vessel, in which no traces of soot were discernible, was filled with wild hazel-nuts and their shells, made black or blackish-brown, but still in good preservation. The fragment of a hammer drawn Plate XXV. figs. 5 and 6 was found immediately above this place, about half an inch deep in the gravel. The material is serpentine; its length from the point to the haft-hole is 3 inches; the greatest breadth is 2 inches 2 lines; the height 1 inch 7 lines; and the width of the haft-hole 8½ lines.

The specimens drawn Plate XXIV. figs. 1 and 4, consisting of flat almost unworked rolled stones from 4 to 5 lines thick, and from 3½ to 4 inches in length, show no further traces of workmanship than the hollows or furrows at *a* and *b*; they may probably be considered as sling-stones or as weights for nets.

Only a few piles are to be seen in that part of the bay to the north-west of the landing-place of Hegne; most of it is covered over with mud, and it is partly dry when the water is very low. A considerable number of celts made of serpentine and diorite, some few fragments of flint, and the remains of great mammalian teeth, have been found here.

The stone celts from this place nearly all exhibit more careful workmanship than usual.

Further excavations here, as well as all the way to Allensbach, would be very likely to yield good results when the water is at its lowest.

The series of lake dwellings on the northern shore of the Untersee may probably close with the settlement of Hegne. The wide lake bottom stretching from the landing-place of Hegne to the old ruins of Schopfeln (Scopula) on Reichenau, is chiefly clay ground, almost without a single rubble-stone. This muddy shallow extends so far into the lake that the inhabitants of the lake dwellings, if there were any on this locality, must have passed three-quarters of the year in a regular marsh, and their egress must have been exceedingly difficult, and often more than a thousand paces in length. Besides this there is a dearth in the whole space of one of the necessaries of life, never, to my

knowledge, neglected by any of the builders of lake dwellings, viz., fresh water in the immediate neighbourhood.

The same remarks will apply to the shore on the other side of the ruins of Schopfeln at what is called the marsh of Wollmatingen, till the Rhine is reached; after which, as the river becomes deep only a very few paces from the bank, and there are no springs of fresh water to be found in the flat marshy ground immediately adjoining all the way to Constance, not a single favourable locality could be found for the erection of the description of dwellings.

The nature of the ground is far more favourable on the other side of the tongue of land in that part of the lake of Constance which goes by the name of the Ueberlinger See.

UEBERLINGER SEE. (WESTERN SHORE.)

The lake dwellings in this district were examined some years ago, and reported on by Mr. Dehoff, and they have also lately been carefully investigated by Mr. Ley. It will probably be better to give the substance of these two reports independently, and we will now take the first in the order of time, which is that of Mr. Dehoff.

'The lake dwellings on this shore extend, though not continuously, from the bay in which lies the island of Mainau along the shore near Lützelstetten* and Dingelsdorf to the north of Wallhausen, a distance of more than two hours' walk. Throughout the whole of this tract stone celts are found, chiefly of serpentine, also in many places corn-crushers, mealing-stones, and pottery.

'From Wallhausen nearly to Bodmann the chain of hills along the bank, consisting chiefly of "molasse," slope precipitately into the lake, and consequently here, from the limited space and the rocky bottom, the locality is by no means fitted for lake dwellings; they are not again seen till the chain of hills retreats, and becomes lower opposite to, and more especially above, the borough of Bodmann.

'Here there is a large lake dwelling about four hundred paces in length, extending from the landing-place to the turn of the lake northwards towards Ludwigshafen.

'Three distinct rows of piles may be noticed in many places, but unfortunately, from their proximity to the land, they have been partially destroyed, and will very soon be entirely annihilated.

'The width of the piled space from the side nearest the land to that farthest in the lake varies from twelve to twenty feet;

* Mr. Ley, of Bodmann, at the close of his report on the settlement near his own town, mentions that the lake dwelling of Lützelstetten is about a quarter of an hour's walk from the town, and stretches out into the lake covering five or six acres; stone celts, whetstones or grinding-stones, pottery, and spindle-whorls are found there. The settlement at Wallhausen is much larger, and runs along the shore, and stone celts and flint implements are found there in such numbers that the collectors call it 'Flint Island.'

the shape of the settlement erected here appears to have been rather a long rectangle.

'A few feet from the shore the bed of the lake is covered with a "relic-bed," varying in thickness from several inches to more than a foot, which is richly studded with bones and teeth of animals, remains of stags' horns, and implements made out of these materials or of stone—or, to speak more correctly, it is filled with them.

'Flint remains were found in one locality, about thirty paces long and about ten paces broad, in very great, and, in fact, in astonishing quantities. They consist not only of chips and refuse of every size and form, from pieces hardly worked and the size of the fist to the smallest fragments, but of saw-flakes, cutting-tools, and arrow-heads, all of which were found in considerable numbers. The abundance of flint remains here is the more astonishing, as this locality before the invention of lucifer-matches, and as far as the memory of man goes back, supplied the whole neighbourhood with the flints they required, and was actually worked as a business for this purpose.

'The flint implement drawn Plate XXIII. fig. 2 was probably used for taking the scales from fish.

'From what has been just said, it appears that in this place there was an actual manufacture of flint implements for a wide extent of country, and this assumption has still more probability if it be taken into account that flint remains, and more especially flint tools, are not met with at all approaching to the number found here in any other lake dwelling of the surrounding district. This circumstance, taken together with the abundance of animal remains, may enable us to form some conclusion as to the age and duration of this settlement, though it must not be ignored that the favourable situation of this place was especially calculated to preserve these monuments of early times for later generations.

'The great number of pieces of stag's horn found here, partly worked and partly in the rough, deserve especial mention. By far the larger proportion of these remains appear to have been parts of horns which had been shed; pieces attached to the skull are very rare. All the specimens which I have seen belonged apparently to the red deer; several were found of unusually large dimensions, but not a single horn was got out entire.

'Some of the pieces of bone are of colossal size, and must have belonged to the largest species known in these parts.

'Many of the teeth found belong unquestionably to the horse; others, of very great size, are those of the ox tribe. Besides these there were found tusks of the wild boar, one of which was more than 3½ inches long; stags' teeth were also met with.

'Amongst the implements of stone, next to those of flint, the celts are the most numerous; they are chiefly made of serpentine, well worked, and ground at the edge.

'The fragment drawn (Plate XXIV. fig. 14) evidently is part of a hammer; unfortunately it is broken, not only at the haft-hole, but also at the point; the original form therefore is only conjectural. It is of serpentine; the whole surface, even that of the haft-hole, has been carefully ground and finished off. This fragment is 3 inches 2 lines long, the breadth in front of the haft-hole is 1 inch 7 lines; the height is 1 inch 3 lines.

'One of the most interesting specimens is probably the front of a battle-axe, drawn Plate XXIV. figs. 12 and 13. It is made out of serpentine, tolerably well finished, and ground all over. The length from *a* to *b* is 3 inches 1 line; the breadth of the cutting edge is 1 inch 7 lines; the width of the helve-hole 11 lines, and the whole breadth at this part 1 inch 10 lines.

'The fragment of a perforated spindle-whorl made of serpentine exhibits also the same careful workmanship.

'(Plate XXV. figs. 13, 14, and 17.) A wider stone implement, apparently an unfinished hammer of serpentine, which has been worked on all sides, partly by grinding and sawing, and partly by strokes of the hammer. A depression about seven lines deep has been made on one side, apparently the beginning of a hole bored with flint tools. The whole specimen is 4 inches 9 lines long; at the hinder end it is more than 2 inches wide; in front its width is 1 inch 9 lines, and the body is from 2 inches 4 lines to 2 inches 1 line broad.

'Amongst the bone implements found here there were several which are generally considered as netting-needles and small chisels.

'Amongst the implements of horn there was a particularly fine base of a stag's horn, with a hole through it, 1 inch 3 lines long by 1 inch wide at the outside, and consequently oval, about 9 lines under what is called the "rose-piece." The brow antler had been cut a line deep with a sharp tool, and then had been broken off. The length is 8 inches, the width at the head 2 inches 6 lines (Plate XXIII. fig. 5). An implement almost precisely similar was found at Robenhausen.

'Besides this there are several ends of stag's horn, which

apparently have been separated from the main branch in a similar way to the brow antler just mentioned, then ground sharp at the pointed end and hollowed at the opposite one: this had evidently been done for some definite purpose; they probably had been used as a primitive kind of lance-points, or, on account of their greater hardness and durability, for some kind of agricultural tools.

'A considerable number of fragments of earthenware vessels were found, many of which had the well-known line ornaments. The material of these vessels had been much more carefully prepared than that of those found in the neighbourhood of Allensbach, the quartz-grains are smaller, and charcoal-dust is mixed with the clay; the whole finish also of the work is further advanced, and the substance of the pottery is thinner and more in proportion to the size of the vessels, probably not more than 2½ lines thick; and yet they have not in any single instance been made with the potter's wheel.' (Plate XXIV. fig. 5.)

The above is nearly an exact copy of Mr. Dehoff's report, made in 1862. We have now to add a report from Mr. Ley of Bodmann, as to the excavation and investigations made by him very lately in the neighbourhood of this town.

'The little map on Plate XXVI. will show the localities of the two lake dwellings lately examined; they are indicated by the letters A and B.

'*Lake Dwelling* A.—The excavation undertaken in December last produced the following objects:—A great number of celts of different kinds of stone, either with or without the well-known stag's horn hafting. Amongst these is a very rare specimen of a flint celt (Plate XXVIII. fig. 31), several stone hammers, either with a round or an oval perforation; mealing-stones, corn-crushers, grinding or whetstones, flint saws (Plate XXVIII. fig. 32); the one drawn may probably be considered unique, as, like the northern saws of flint, it has a sickle-like shape; arrow-heads of flint; a bow of yew-wood (*Taxus baccata*) four feet long; bone chisels and piercing tools; clay spindle-whorls; an earthenware vessel with a handle; horns of the stag, the roe, the goat; bones of the pig, the horse, &c., and teeth of several carnivorous and herbivorous animals.

'This settlement, which belongs to the stone period, for as yet no bronze implement has been found in it, appears either partially or entirely to have been burnt down, and after some considerable time to have been again inhabited. Upon the original lake bottom into which all the piles were driven there

is first a relic-bed from half a foot to a foot thick, and upon this there is in many places a bed about 2⅓ inches thick, containing burnt matter. Above this again there is a layer of mud about 2⅓ inches in thickness, on which lies a second relic-bed from 2⅓ to 6 inches thick, and then comes a bed of gravel, sand, mud, &c., from 1¼ to 2 feet in thickness.

'In the lower relic-bed there are fragments of roughly-made pottery and stone celts, stags' horns and bones very much decayed, and a quantity of hazel-nuts, &c. In the upper relic-bed many neatly made polished stone celts were found; some perforated stone hammers, which are not met with in the lower bed; stone chisels with haftings of stag's horn; well made bone chisels; stags' horns in a good state of preservation, and a better kind of earthenware, in some cases ornamented. From all this we may in the first place see indications of an advance in handicraft ability amongst the colonists,* and secondly, a decided proof that the locality was not inhabited for a considerable length of time, during which the bed of mud 2⅓ inches thick was accumulated.

'Bones, pottery, hazel-nuts, &c., are found in both relic-beds. The colour of the pottery is black or grey, and the clay has been mixed with fine sand. Flint-flakes are so abundant that I got a whole basketful. I lately found a vessel like that drawn Plate XXXI. fig. 6, and it contained about 600 beads, some of which are drawn Plate XCV. fig. 7. They consist, according to the determination of Swiss geologists, of Diceras oolite, a kind of stone which extends from Wangen near Solothurn to the Bernese Jura. The perforation of these beads, like that of the stone celts, has been begun from both sides (see the section). The thread on which they were strung fell to pieces when they were taken up.

'The piles are of oak, fir, pine, round-leaved willow, aspen, birch, &c. Some are whole stems, some split, but all are quite rotten.

'*Lake Dwelling* B.—About 550 yards north of the settlement just described, at the end of the Ueberlinger See, I discovered some little time ago a number of piles driven into what is called the "slope" (Halde), where the lake suddenly becomes deep; they extend at least over ten acres, and come close to the shore; they project from the bottom from half an inch to two feet, and

* This supposition is at variance with the observations made at other stations of the stone age. See the remarks made at the end of the account of the lake dwelling of Robenhausen.

for the most part are in a better state of preservation than those of the lake dwelling at A. In some piles which I had drawn up from a depth of six feet, I remarked that they had been hewn with sharp cutting instruments, from which it appears that this settlement belongs to the bronze age. In fact, after searching in vain for a length of time for bronze implements, I succeeded in finding three bronze celts, of which two were of the flat kind and the other had shaft flanges; and also a clothes-pin. Besides these, I got up from a depth of six feet four objects of iron; viz., 1 knife, 2 arrow-heads, 1 fragment of a fish-hook, also a mealing-stone and fragment of pottery. The greater part of the settlement is covered deeply with mud, so that it is difficult to examine it.

'The pottery is for the most part ill-burnt, and the clay has been mixed with coarse quartzose sand; most of the vessels are ornamented in a similar way to those from the other settlement, and in neither case has the potter's wheel been made use of. It is a singular fact, though the quantity of mud renders it difficult to ascertain this positively, that the bottom is regularly covered over with beams. Split pieces of oak, $2\frac{1}{3}$ inches thick, $9\frac{1}{2}$ inches broad, and 3 feet long, are frequently met with: they have in the middle a hole about six inches in diameter, through which a pile has been driven in the lake bottom to hold the wood firm. The piles and beams lying about on the bottom are charred. The only other objects I have found showing traces of workmanship are a piece of stag's horn, some flint-flakes, &c. No actual stone implements have been met with.'

60531

UEBERLINGER SEE. (EASTERN SHORE.)

The stations described in the following pages are situated in the north-west arm of the lake of Constance, called the Ueberlinger See. They do not afford any fresh point of view as to the nature of lake dwellings in general, nor do they extend our knowledge of the manner of life and industrial abilities of the colonists. And yet their discovery and investigation form an important contribution to our knowledge of these localities; for while hitherto all that we knew about them seemed to bear out the assumption that the settlements in the north-east of Switzerland had been abandoned before, or almost immediately after, the introduction of metal implements, now we find amongst a number of settlements, exclusively belonging to the stone age, a station which indeed was founded and flourished at this period, but continued in existence till the new material had come into use for all the implements of domestic economy and the chase, as well as for the objects used as ornaments.

With respect to the implements of the stone age found here, we do not find many new forms among those made of stone, bone, horn, or wood; they agree in general with those of other lake dwellings. If we see a difference in the materials made use of for the stone implements, this circumstance is easily explained by the peculiar varieties of stone employed by the settlers which came from the Rhætian High Alps. A greater variety of shape is seen in the pottery, and some forms are found here which have not been met with in any other locality.

If we examine the implements of the bronze age found here, we shall find that not the slightest difference is to be seen between them and the implements met with in the lake dwellings of Western Switzerland, and we are led to believe that both came from the same foundry.

We have further to remark that, especially at Unter Uhldingen, a number of iron implements were discovered, which might appear to justify the opinion that this settlement lasted till the iron age; nay, even as late as the Roman and Allemannic dominion in these parts. But on carefully examining these objects.

some of which are drawn on Plate XXVIII., it will be found that not a single specimen has been met with belonging to what is called the first iron age; consequently there is a complete gap between the end of the bronze age and the first century after Christ; the Roman period is only represented by some fragments of tiles, and all the other things date from the time of the Allemanni and the later centuries of the middle ages. It is not, therefore, proved that this station lasted till the iron age, still less can it be shown that it existed in the first century of our era: and we have the greater reason for doubting that the settlement was actually occupied at this period, as there is an entire dearth of all corresponding household and handicraft implements.

If we bear in mind how many implements of all kinds have, in the course of centuries, fallen to the bottom of the lake, partly by shipwreck, which must frequently have happened in early ages from the inferiority of the boats, and partly thrown away as refuse, especially in the neighbourhood of villages, we shall see that the greatest care is necessary in determining the age of specimens brought to light by excavations on the shores of the lakes.*

We are indebted for our knowledge of these settlements to Mr. Ullersberger and Dr. Lachmann of Ueberlingen, who have bestowed much care and attention on their discovery and investigation. Dr. Lachmann has described these stations very minutely; the following is the substance of his account:—

'Of all the settlements discovered within the last seven years in the lake of Constance, those of the north-western arm, called the Ueberlinger See, are the most important on account of their extent, and the number and beauty of the antiquities found there. And what increases the importance of these settlements still more, is the fact that not only the antiquities of the stone age to which the other settlements in the lake of Constance belong, but also those of the bronze age, are represented in their remains.

'We owe the discovery and the knowledge of these singular antiquities to Mr. Ullersberger of Ueberlingen, who for some years past has investigated the settlements very carefully, and has preserved all the specimens in a regular collection.

* Iron implements are found in stations like Sipplingen, and several on the western lakes, where not a single object of bronze has been met with, and also very commonly in places where there have been no lake dwellings. They are often found associated with roofing tiles in those lakes on the banks of which there were Roman stations.

'The immediate discovery of the lake dwellings arose from finding large quantities of flint: this mineral occurs only in the chalk strata, and as the district of the lake of Constance belongs to the "molasse" formation, flint is not found there naturally. Notwithstanding this, it is met with in such abundance in many localities on the shore of the Ueberlinger See, that the inhabitants have been accustomed from time immemorial to draw their supplies of flint from the shores of the lake without exhausting the store. The great abundance of this mineral, which had evidently been brought here by man, led Mr. Ullersberger to think that as flint was the material of the greatest importance to the ancient inhabitants, it was very probable that lake dwellings were to be found on the shores of the Ueberlinger See. He carefully examined all the available localities in the winter of 1862–3; the correctness of his supposition was proved, and since then he has collected the antiquities of the district with untiring energy.

'The available time for the investigation is, however, quite limited, for the level of the water in the lake of Constance is subject to periodical changes, being highest in summer and lowest in the months of January and February. The highest known level was that of July 1817, which is therefore marked with O on the scale given in Plate XXVI. The lowest level known was in the winter of 1853–4, and is thirteen feet and a half under O: the medium water-level consequently is about seven feet under O. In December 1864, the level was eleven feet and a half under O. When the level of the water sinks thus in winter, and more especially in February, the investigation of the lake dwellings is greatly facilitated, as some of them are laid dry and they become easily accessible. In fact, the nature of the shore is such that at that time, even when the water has sunk only a few feet, a large extent becomes perfectly dry. For the Ueberlinger See partakes of the character of the whole eastern shore of the lake of Constance, along which a kind of terrace several hundred feet wide, consisting of beds of sandstone and clay, stretches out into the lake nearly horizontally, and then slopes suddenly down to the bottom of the lake. It is only in a few places, and particularly near the mouths of brooks or streams, that this bank is covered with stones, gravel, and sand. At low water it is for the most part dry and easily accessible; when the level is high it is often six feet or more under water.

'On this terrace, which goes by the name of the "lake-slope,"

(Seehalde), there are the remains of five lake dwellings on the eastern shore of the Ueberlinger See within the limits of a short three hours' walk; viz., the stations of the stone age of Nussdorf and Maurach, and those of the bronze age of Unter Uhldingen and Sipplingen. Plate XXVI. gives a little map of the district. The shore at these places rises more or less abruptly out of the lake, and is a fruitful, sunny hill-country, covered with fields, meadows, forest, and vineyard, affording a charming distant view of the opposite shore and the Swiss mountains.

'The settlements of the stone age shall be first described: they are situated near the shore, varying somewhat in distance from it: they were first seen when the water became low, and in consequence were the earliest discovered.

'I. *The lake dwelling of Nussdorf*, which was discovered in the winter of 1862-3, extends over a parallelogram of about three acres on the shallow shore, and exhibits some thousand piles in straight lines and at pretty regular distances apart. Though these piles have rotted off down to the lake bottom, and only a small number when the water is low appear above its surface, yet so many remain that we may be fully satisfied as to their nature and use. In general they are about two feet apart: sometimes several are found together, from three to six in number, but they seldom stand in pairs. The average circumference is one foot, but there are piles varying in this measurement from six inches to two feet. The wood of which they were made is of the kinds found in the neighbouring forests, viz., fir and oak. Generally they are made of whole stems; only a few are split. They are so much decayed that they can easily be broken in two by the pressure of the fingers. The part remaining in the ground is the best preserved, while that which, from the changes of level in the water, has been exposed to the influence of the atmosphere (or what sailors would call "wet and dry") has for the most part decayed away.

'Traces of fire are seen on many of the piles, a proof that the settlement was destroyed by conflagration. The upper bed of the ground in which the piles were driven consists of about half a foot in thickness of rolled stones, gravel, and sand. Under this is found what is called the "relic-bed," containing the antiquities, and consisting of organic remains, the stumps of piles, the refuse of feasts, &c. This bed is about nine inches thick. Then follows the blue clay of what is called the "lake-slope."

'The antiquities found at Nussdorf shall now be described.

'*Flint Arrow and Lance Heads, Piercers, Knives, and Saws.*—Amongst the materials of the implements found at Nussdorf, flint takes the first place. Pieces in the rough and refuse of a black and more rarely of a yellow colour, and varying in size from that of a small flake up to that of the fist, are found really in countless numbers. The greatest pieces weigh about ¼ lb. On some of the specimens the chalky crust still remains.

'Nearly one hundred specimens of arrow and lance heads were found here; the shape in general is that of an acute angled isosceles triangle, with the upper and lower surfaces more or less even (Plate XXVI. fig. *a*). There are, however, several variations from this normal form, of which we will only instance the following. Sixteen specimens had the lower side, or that opposite to the point, concave, Fig. *b*; or this lower portion was continued in a projection varying in form, Figs. *c*, *d*, *e*. The surfaces are either both alike, and even or somewhat curved, or only one side is arched while the other is flat, or the sides consist of two planes, so that there is an angle or ridge in the middle. The sections of these different varieties are shown below.

'The size varies from ½ an inch to nearly 3 inches, and there are all possible gradations between the two. The size, however, bears no particular relation to the shape, for specimens of similar size exhibit different forms, and *vice versa*. If the smaller specimens are called arrow-heads, and the larger ones lance-heads, we have found eighty of the former description and twenty of the latter. Sometimes they are admirably manufactured. In some cases they have been split so thin as to be quite translucent, at least at the edges. Those which have the kind of stalk or projection before referred to are the most highly finished, the best example of which is that drawn Fig. *d*. We have only further to mention that of all these implements only two were of any other material than flint, viz. one arrow-head of serpentine, and one of translucent quartz.

'About eighty specimens of saws, piercers, and knives were found at Nussdorf; they are chiefly tongue-shaped, or like a spatula with the surface somewhat curved (Plate XXVII. fig. 13). They are pointed more or less at one end, and are blunt at the

other (Fig. 12). If the point is sharp, these implements somewhat resemble lance-points, but if rounded, they seem more like knives. The edges are serrated; most of them have the teeth sharper on one side than on the other (Fig. 10). One of the surfaces is even and smooth, while on the other side there are one or two angles, and consequently two or three narrower planes lengthwise. The length varies from 1 inch to 7 inches; the breadth from half an inch to more than an inch and a quarter. Five rather long oval saw-plates were made particularly well; they are from 3½ to 4¾ inches long, and from ¾ inch to 1¼ inch broad (Plate XXVII. fig. 14). One unique specimen has the form almost of a regular rectangle, with sharp corners; the side planes are quite even and smooth, and only one of the longer edges is serrated (Fig. 20).

'The flint saws in general are 3½ inches long and 2 inches high; they are made of black or yellow flint. Eight specimens which were found set in wooden handles show us very satisfactorily how they were used. The handle is in the shape of a weaver's shuttle, made of yew-wood, and the saw is let in perhaps half its breadth and fastened with asphalt. The handle is perforated and very neatly made (Plate XXVIII. figs. 9 and 10).

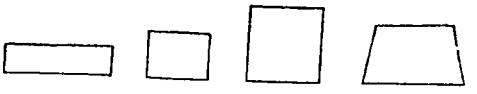
'*Wedge-shaped Implements (Celts, Chisels, Axes, Hammers, &c.)*—Implements of this description form by far the larger proportion of the whole collection. At Nussdorf alone about 1,000 specimens were found, chiefly in a good state of preservation.

'They appear to have been made partly out of the rolled stones found in the lake close by, and partly from materials brought from a distance. The collection contains nearly fifty celts made out of nephrite (probably a foreign mineral), and numerous specimens are met with made of serpentine, diorite, augite, epidote, decomposed green schist, basalt, porphyry, gneiss, &c.

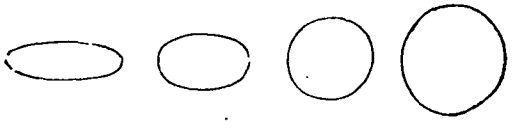
'The shape of these implements, however much individual specimens may vary, may be traced up to the normal form of the hatchet, wedge, or celt, for each of them has five planes and nine corners. Four of the planes form the sides, the two opposite ones being similar; the two narrow side planes run to a point at the cutting edge; the two broader planes form this edge at their junction. The remaining plane, or that opposite to the cutting edge, is sometimes ground and sometimes left rough. The section in the middle is a rectangle. There are a number of variations from this normal form; in fact, this

occurs to such an extent, that of the whole number of celts found, no two are alike; they may, however, be divided into two main classes, one containing the celts without a helve-hole, and which consequently had to be set in wooden clubs, the other including the celts with helve-holes, like our modern hatchets, into which wooden handles were fixed.

'The unperforated stone celts approach the nearest to the normal form. The section in the middle forms a rectangle, seldom a trapezium (Plate XXVII. figs. 3 and 7; Plate XXVIII. fig. 6).



'If the side planes, however, are convex, and the corners at the sides blunted or rounded, the section in the middle forms an oval or a circle, and the specimens become cylindrical (Plate XXVII. figs. 1 and 2). Thus in section—



'Some specimens may be considered as transitions between these two classes; the side planes are convex, but the corners are not rounded off, so that the section becomes a rectangle made with curved lines, thus—

'These implements, however, cannot all be definitely divided into these three classes; for many varieties exist between them. In Mr. Ullenberger's collection there are many specimens of which the section is an oval or a convex rectangle.

'Besides the forms just described, several implements have been found approaching very nearly the shape of a common chisel (Plate XXVII. figs. 18 and 21).

'The size varies as much as the form. Some of the unperforated celts have the following dimensions: length, 7⅓ inches;

breadth, 2½ inches; circumference lengthwise, 15½ inches; circumference round the middle, 7 inches; weight, 2¼ lbs. On the other hand, the smallest specimens measure as follows:—length, ¾ inch; breadth, nearly ½ inch; circumference lengthwise, nearly 1⅜ inch; circumference round the middle, rather more than an inch; weight, about half a drachm. (Plate XXVII. fig. 9; Plate XXVIII. fig. 5.) There are specimens of all sizes between these two extremes; in general, those with round or oval sections are larger than those where the section is angular.

'The cutting edge of these implements is almost always ground sharp, but there are cases in which the planes forming the edge meet at rather a wide angle, and in consequence each plane is again divided into two by a ridge (Plate XXVII. fig. 5). The side planes are either not ground at all or very little so, and in that case show more or less the natural fracture of the stone, or they are smooth like the cutting planes: the first case is more usual amongst the cylindrical celts, the latter amongst those which are wedge-shaped. We may mention as a specimen, unique of its kind, the small celt drawn Plate XXVII. fig. 6, which towards the upper end has a ring-like projection running round it.

'Several specimens found at Nussdorf show that some of the celts were hafted in the same manner as those of other stations. Three stone celts were met with fixed in the well-known handles or cases made of stag's horn, the upper part of which, the root of the horn, and the actual case or hafting, shows its natural surface: into this the celt was fixed and fastened with asphalt. The lower part of the stag's horn was cut into a rectangular form (Plate XXVII. figs. 16 and 19), in order to be fixed into a wooden club so as to be used as an axe. The complete implement, viz., club, hafting, and celt all united, has never yet been found on our shores, but specimens have been met with in other settlements. It may, however, be doubted whether all the unperforated celts were used with this artificial handle. The three celts which we found hafted belong to the smaller implements with the section rectangular. This fact, together with the enormous quantity of axes and celts, compared with the extremely small number of horn haftings, may justify the supposition that it was chiefly the smaller celts with angular corners which were fixed in this artificial hafting, while the larger implements with a round or oval section were actual tools in themselves, and needed no hafting. This hypothesis is supported by the consideration that one of these celts, ground

to a sharp edge, weighing nearly 2 lbs., and well adapted to the hand, would not merely be a good tool but also a weapon.

'There is still another way of fastening the celt to the handle: a stock or branch, 1¼ or 1½ inch thick, was chosen, probably of hazel, with a root running from it at right angles. A cleft was then made in this shorter part, forming a kind of beak, in which the celt was fixed with cord and asphalt. Haftings of this kind are found not only in our district, but are also common at Wangen and Robenhausen. (Plate XXVIII. fig. 24.)

'The perforated celts, or those with a helve-hole, are much more rare than those of the other description. Amongst the large number of stone celts found here there were only fifty with helve-holes, and only a few of these were perfect.

'Amongst the celts of this kind there are some specimens which have the axe-like form of the previous class (Plate XXVII. figs. 17, *a*, and *b*), and they have the same number of corners and planes. But while the unperforated celts become broader towards the cutting edge, these are more equal in breadth; sometimes, in fact, they become narrower towards the edge, so that the breadth of the two planes forming the cutting edge is very much smaller than that of the other two planes (Plate XXVII. fig. 4). One unique celt with a helve-hole exhibits a broad wing-like cutting edge (Fig. 23). The upper end, opposite to the edge, is either a plane with sharp corners, or it is rounded and convex. The helve-hole is either made in the middle of the implement (Fig. 22), or somewhat nearer the blunt end. The shape of the hole is either circular (Figs. 4, 17, and 22), or oval, as in Fig. 11. Sometimes there are two helve-holes, one behind the other; they are in that case either both round, or one is round while the other is oval (Fig. 24). In some specimens the celt is thicker or swells out where the hole is made. Sometimes in the unfinished celts two perforations may be seen begun at the opposite sides with the intention of meeting, and at the bottom of each hole there is a central projection, which proves that they were bored by a hollow tube-like instrument. (Compare Plate XXVIII. fig. 2, from Sipplingen.)

'With respect to size, there is not the same difference between the largest and the smallest which is found in the unperforated celts. The length varies from nearly 3 inches to 7¾ inches; the breadth from 1¼ inch to nearly 3 inches, and the diameter of the helve-hole from ¾ inch to 1¼ inch.

'The workmanship indicates not only a considerable amount of skill in manipulation, but also a care for symmetry and ele-

gance of form. All the surfaces are ground smooth, the corners are regular and sharp, the round and convex portions are perfectly well formed. On some specimens there are ornaments of engraved lines which commence on both sides of the helve-hole and converge towards the point (Fig. 22), or a single line—a furrow—runs in the middle from the helve-hole towards the cutting-edge (Fig. 23).

'It is very evident that these implements had handles like our modern hammers, to which they bear a great resemblance; but whether they were used as tools or as battle-axes may remain doubtful. The small number of specimens of this kind, their fragile nature, their unimportant size, the labour bestowed on their manufacture, the ornaments which occasionally are found upon them—all these facts lead us rather to suppose that they may be considered as objects of ornament or distinction.

'Thirty specimens of what are called fruit-crushers and mealing-stones have been found here, twelve of which were round and eighteen rather long in shape. (Compare Plate II. figs. 8 and 11.)

'Several stone implements were met with, the use of which is uncertain. Some of them are small flat plates or slabs, round or angular, and perforated, varying from about half an inch to an inch and a quarter in length, and from a quarter of an inch to more than three-quarters of an inch wide (Plate XXVIII. fig. 7); others again are rather long stones, somewhat in the shape of a cylinder, with a hollow running round the centre: they are from $1\frac{1}{4}$ to $2\frac{1}{2}$ inches long, and from $\frac{1}{4}$ inch to $\frac{1}{2}$ inch broad. Several specimens of this kind were found at Nussdorf. A little perforated plate of red sandstone, $2\frac{1}{4}$ inches long and $1\frac{1}{2}$ inch broad, is drawn Plate XXVII. fig. 8; it is nearly rectangular, but thicker in the middle, and is perfectly blunt at both ends. And lastly, a stone, the shape of which is like half a stone hammer broken off at the haft-hole, but yet has the corners rounded; it has a furrow down the middle on each side. (Plate XXVII. fig. 15.)

'We will not venture to decide whether these perforated objects were strung on a string and worn as ornaments or amulets, but this seems probable from their being perforated; and we must also leave it undecided whether the specimens with hollows running round them were merely objects in the process of working, or whether they were complete in themselves and were used for some purpose or other, as they are now found.

'The objects made of clay found at Nussdorf are very indifferent specimens of the potter's art, made without any regularity, and rough on the outside; they were made with the hand alone, and hardened in the fire. The colour is dark grey, often black; the material is a grey loam mixed with small grains and pebbles.

'Only a few fragments of earthenware vessels were found; nothing perfect was met with. The thickness of these fragments varies from 1½ to 10 lines, but in some places they are thicker and in others thinner, for the curve is not uniformly made. Most of the specimens are simple and without ornaments, but on some of them there are irregular engraved lines or dots; others have parallel ridges or hollows running round the outside. The perfect vessels, judging from these fragments, seem to have varied in diameter from 2½ inches to 2 feet.

'Twenty-five spindle-whorls made of clay were found at Nussdorf in every respect similar to those found at other lake dwellings. (Compare Plate III. fig. 13.)

'Balls made of clay, coarsely worked and about the size of an orange, were found lately at Nussdorf in great numbers. They probably were used as weights for the loom.

'*Objects made of Organic Materials.*—A large number of specimens falling under this description were found at Nussdorf, not only the remains of animals and plants, but also the tools made out of them.

'The bones, horns, and teeth belonged to the following animals:—Horse, urus (*Bos primigenius*), marsh cow, stag (*Cervus elaphus*), roe, sheep, marsh pig, bear (*Ursus Arctos*), dog, wolf, lynx, hedgehog, and beaver; remains of the pike and other fish were also met with. The bones are seldom found whole; a large number of the long bones had been opened lengthwise; the broad and short bones had been broken to pieces. On some specimens are still to be seen traces of the use of stone implements in the shape of notches and incisions. Some of the animals' skulls have a hole made in the parietal bone, probably to extract the brain. Amongst the more perfect specimens are several fine skulls and under-jaws of the marsh pig, the skull of a lynx (?), some under-jaws of the beaver (*Castor fiber*), hedgehog, &c.; also shoulder-blades, ribs, and tarsal bones of the marsh cow, some vertebræ of bos primigenius, &c.

'The antlers and horns are also for the most part imperfect, though a few horns of the stag (*Cervus elaphus*), and also of the roe, were found whole; there were also rudimentary horns of these animals, and some horns of the marsh cow.

'A great number of teeth were found belonging to the horse, the boar, the dog, the stag, the bear, the beaver, the hedgehog, &c. The remains of plants are as abundant as those of animals. Hazel-nuts are very plentiful in the "relic-bed," most of them perfect; some apples were also found. Grains of corn, bread, &c., have not yet been met with.

'Seven hundred specimens of implements made from bones, horns, and teeth have been found here.

'Some bone implements were made out of the whole bones of small animals, and others out of splinters of those belonging to larger beasts. The bones of the extremities were chiefly used for this purpose, such as the radius, ulna, femur, tibia, and fibula; some were ground all over, and some only at one end.

'The little axes or celts of bone have in some measure the form of those made of stone, only they are thinner and more neatly manufactured. In some cases the two surfaces are even; in others they take the natural form of the piece of bone, and the tool then becomes more like a gouge. They are made out of the bones of the larger animals (Plate XXVIII. fig. 14).

'The chisels are rather long flat tools with a narrow but sharp edge; they are either broader at the handle than at the cutting edge—and in that case the head of the bone forms the handle—or they are of the same breadth throughout (Plate XXVIII. figs. 12 and 13).

'Netting-pins and hairpins were found in great numbers; they all have the point ground sharp. They are either made of the whole bones of one of the extremities, one end of which was ground to a point, or out of splinters of bone. The size varies greatly, from seven lines to ten inches (Plate XXVIII. fig. 11).

'Several bone implements were found, the use of which is unknown, such as cylindrical pieces of bone ground smooth and either perforated or solid; also implements some inches long, narrower, either cylindrical or flat, sometimes perforated or with a ring-like hollow towards one end (Plate XXVIII. figs. 18 and 23).

'The implements made of horns of the stag and roe, like those of bone, were used for all sorts of purposes: we have found awls, pins, cutting implements, little celts and chisels, all made of bone, and also similar objects to those of which the use is unknown. Together with these the following implements were met with:—

'Sixteen hammers, from 4¾ inches to 7 inches long and from

1¼ to 2⅓ inches broad: they are made out of the main branch of large stags' horns smoothed all over, and they have an oval or angular helve-hole. Part of the wooden handle was still remaining in one of these hammers (Plate XXVIII. figs. 20 and 21).

'Three combs were also found, made out of a flat piece of stag's horn (Plate XXVIII. fig. 8).*

'The teeth used for making implements were chiefly the corner-teeth of the pig, the dog, and the bear: the molars were seldom applied to this purpose. Implements were sometimes made of whole teeth, but more frequently only portions were used, as, for instance, the outside of long teeth like boars' tusks. All the implements made out of teeth are neatly made, well polished, and in a good state of preservation; a few will now be enumerated.

'Netting, hair, or clothes-pins, made out of boars' tusks and consequently curved; they have a sharp point, and are sometimes notched at one end, probably caused by the use to which they were applied (Plate XXVIII. figs. 16 and 17). The pins for making fishing-nets were made out of the corner-tooth of a bear, and perforated (Fig. 15). A fishing-hook was found here made very neatly out of a boar's tusk: it is the second specimen of the kind which, to our knowledge, has been found in the lake dwellings. To make a hook of this kind the middle portion of a split boar's tusk had two large perforations made in it by a drill, and then the upper and intermediate part was scraped away; the remaining portion was easily made into a hook of the required form. (Compare the hook from Moosseedorf, drawn Plate XXII. fig. 5.)

'We may consider as ornaments some corner and back teeth of the dog (wolf?) with the fang perforated: they are too small to have been used as tools, besides which perforated teeth with two or three fangs could have been of no practical use. They were probably strung together and worn round the neck. Twenty teeth thus perforated have been found, of which sixteen were corner-teeth and four were molars (Plate XXVIII. fig. 19.)

'A little spoon-like implement was found lately, made out

* At the late meeting of the British Association at Birmingham, a number of specimens were exhibited which had been obtained from the recent excavations in Kent's Cavern near Torquay, and amongst them a comb very similar to that above described. It is much to be regretted that no drawing has yet been published of these interesting relics to which we can refer.—[Tr.]

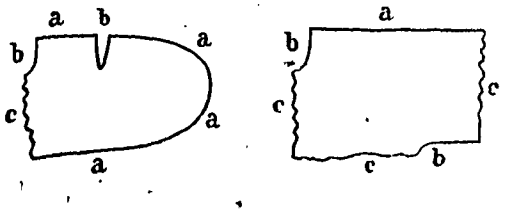
of a boar's tooth; it is the only one of its kind. The upper part, or what is called the crown of a tusk, has been hollowed out and rounded. The implement is neatly made.

'The above are the whole of the implements found, and all of them are made either of stone or of organic materials. No copper, bronze, or iron, has been met with, so that we may safely conclude that the lake dwelling of Nussdorf belongs to what is called the stone age.

'II. The lake dwelling of Maurach was also discovered in the winter of 1862–3. It is about half an hour's walk from Nussdorf. It extends over a long rectangle, containing about eight acres and covered with many thousand piles. It comes close up to the shore, but stretches about 1,000 feet into the lake. Although this settlement is so very extensive, it is not rich in antiquities, nor has it, in fact, an actual "relic-bed," which may be ascribed to the fact that several years since a bank or dam was made here, so that not only the "relic-bed" was turned over and a mass of antiquities destroyed, but also the investigation of the place is very much impeded. Fortunately, however, so much remains standing that the size and character of the settlement can be distinctly made out.

'The piles are precisely the same in every respect as those of Nussdorf, and the same may be said of about 600 specimens of arrow and lance-heads, saws, chisels, celts, hammers, &c., found here.

'There were also several unfinished axes or celts, and the stones out of which they were to be made, some of which had merely incisions made in them, or were partially hammered into shape. One of these specimens, taken from a rolled stone, is rather flat and of a roundish form, 8 inches long and $2\frac{1}{3}$ inches thick; it has two furrows worked in it parallel with each other, about half an inch deep and an inch apart. Another stone has not only vertical but horizontal incisions. The sections of these two specimens are given in the following woodcut. In this section *a* represents the natural surface, *b* the incisions, and *c* the place where it was intentionally broken.



'Some celts also were found in which the planes forming the cutting edge were very finely polished, and the edge was uncommonly sharp, while the other two planes were very little ground and showed traces of the original sawing.

'The mode of manufacturing celts has been before described: the stones were first sawn partly through, then broken, then partially hammered into shape, and lastly ground to the required form.

'A careful search was made for pottery, but no specimens were found, and the same remark will apply to the remains of plants and animals as well as to implements made out of these materials—a circumstance which may probably be explained by the destruction of the relic-bed.

'On the other hand, a perforated flattened bead of amber was found, more than an inch high and nearly an inch and a half broad; the amber is opaque, yellow, cloudy, with whitish veins and spots.

'The only object of metal found at Maurach was the anterior part of a *copper* axe or celt.

'In spite of this copper implement, we must consider Maurach as a settlement of the stone age; for the remainder of the antiquities, the nature of the erection, its situation on the shore, &c., perfectly agree with the stone station of Nussdorf, while the bronze lake dwellings of Unter Uhldingen and Sipplingen exhibit very different features from those of these stone age stations. Besides which, this single object of metal may have been brought to Maurach by accident.

'The bronze and iron stations differ from those of the stone age not merely because, together with implements of the stone period, those of bronze and iron are found in them, but also because they are situated at a greater distance from the shore, and consequently in much deeper water, so that even at the lowest level they never rise above the surface. Besides this, the piles are fastened together with cross-beams, and the whole structures were strengthened by stones heaped together, so that they actually stood upon "steinbergs" or hillocks of stones. The implements also are more perfect than those of the stone age. The following bronze and iron stations have been found on our shores:—

'I. The lake dwellings of Unter Uhldingen, which were discovered late in the year 1864, are situated near the village of this name, about an hour and a half's walk from Ueberlingen,

nearly half-way between that place and Meersburg. There are two settlements, lying about 1,000 feet from the shore, and at a distance apart equal to a quarter of an hour's walk on land. One of them is on three, the other on four stone hillocks, about four or five feet high and made of rolled stones intentionally heaped together. When the water is low the summits appear above the surface; when the water is high they are eight or ten feet below it. Each of the settlements extends over eight or ten acres, and the number of piles may probably be 10,000; they are of greater diameter than those of Nussdorf and Maurach, but in other respects they are similar.

'It may also be noted as peculiar, that at the bottom of the lake, between the individual piles there are cross-beams, some of them still in good preservation, which have probably been used for binding the piles together, and thus strengthening the substructure. As the foundation on which the whole stands is a hillock of stones, there can of course be no actual "relic-bed;" the antiquities lie between and on the masses of stone, and correspond with the improved mode of erection, for besides the objects of stone and clay usually met with in the settlements of the stone age, we find here well-made tools and weapons of bronze and iron.

'But few words will be necessary as to the stone implements found here: they have in general the same character as those of Nussdorf and Maurach. They consist of the following objects:—Arrow and lance-heads. Flint saws, one of which is nine and a half inches long. Three hundred celts, chisels, and axes without helve-holes; some specimens are a foot long; a few were found with helve-holes, one of which is neat and well made, and might be used also as a hammer (Plate XXVIII. fig. 1). Two unfinished stone hammers, which have the usual form of those which are perforated, but yet there is no hole through them. All these implements, in the shape of a wedge, were precisely of the same kind of material as the celts of Nussdorf and Maurach; and the same may be said of the "fruit-crushers," mealing-stones, and grinding-stones, the net-sinkers, little flat perforated disks of limestone, stone hammers formed like a club, implements like a bar or staff, and some other objects of peculiar form, the use of which is unknown.

'The objects made out of clay are in general better formed than those of the stone age settlements.

'Forty spindle-whorls were found here, somewhat larger than those from Nussdorf and Maurach.

'Pottery is met with very abundantly, but unfortunately chiefly in fragments.' A hundred and thirty pieces were found, each differing essentially from one another in material, form, ornamentation, size, and hardness. As far as we can judge from the specimens, there was the greatest variety of shape, so that we may mention dishes, cups, jars, vases, crucibles, covers, vessels with handles, &c. Many of them had a very small base and a very large bulge. Some of the vessels which are perfect, and which very much resemble our modern plates, have the peculiarity of being ornamented, not outside, but inside, within the cavity, with designs either in relief or engraved (Plate XXX. figs. 4, 5, 6). Some of the vessels are plain and some ornamented; in the latter case the designs are either indented or in relief, and consist of points or lines, the latter forming figures, such as triangles, &c. Annular and spiral ornaments are also met with. In some cases a great deal of taste is displayed in the ornamentation (Plate XXX. figs. 4 and 7). The size varies greatly, some of the vessels being only two and a quarter inches, while others are upwards of two feet in height. The larger proportion have been well burnt.

'We will select for illustration a few of the perfect vessels. Four bowls, one with a handle; two vases; two flat or broad vessels, contracted above so as almost to form a kind of neck, Plate XXXI. figs. 2 and 3. Two cups, Plate XXX. figs. 8 and 9. A crucible, Plate XXXI. fig. 6. Two ornamented covers, Plate XXX. fig. 2, and Plate XXXI. fig. 1. Besides the above, some pottery was found of pretty red clay (*terra sigillata*), which was of Roman origin.

'Together with the implements we have mentioned, made of stone and clay, there were found a large number of bronze tools and weapons which undoubtedly prove that bronze was both manufactured and used on the shores of the lake of Constance in prehistoric times. These objects were all cast evidently by good workmen, and they are ornamented like all the other implements of the bronze age. The following specimens may be especially mentioned:—Six lance-points (Plate XXXII. figs. 14, 15, and 16). A number of celts, one of them with ridges for the shaft (Plate XXIX. fig. 20, and Plate XCIV. fig. 4), and sixteen specimens with flanges made for wrapping over it, some of which are from the same mould. One of the bronze celts found here is peculiar, as it has the shaft flanges not at right angles to the plane of the cutting edge, but in a line with it (Plate XXVIII. fig. 30): a similar arrangement has been previously

described. Two socketed celts (Plate XXIX. fig. 26), and two implements like chisels (Fig. 25). Twenty-five knife-blades, chiefly in a good state of preservation, and ornamented; some, however, are a little damaged (Plate XXXII. figs. 1 to 13). Sickles like that drawn Plate XXIX. fig. 23. Fish-hooks, one of which is very large (Plate XXIX. figs. 21 and 22). Eight bronze rings. Four armlets, some of them beautifully ornamented (Plate XXIX. figs. 1, 2 and 24). More than a hundred pins of different sizes; the heads are ornamented with considerable taste: they probably were used as clothes or hair-pins, or for sewing or netting (Plate XXIX. figs. 3 to 18). A pair of compasses of bronze: it is uncertain whether this specimen is of the same age as the other bronze implements.

'Several iron implements were found at Unter Uhldingen; the following are some of the most interesting:—One lance-head, and five arrow-heads, like those of bronze (Plate XXVIII. figs. 26 and 27). One axe or celt. Two tools like carpenters' chisels. Twelve knife-blades, in fact nine like our common knives, of which one has a handle, the end of which is formed by a knob of bronze. Two sickle-like vine-pruning knives (Plate XXVIII. fig. 25). Also a dagger-shaped knife; an iron ring; a long triangular plate of iron with a ring at one end (steel for striking a light?) (Plate XXVIII. fig. 29). A fibula; a clothes-pin. The remains of an iron two-edged blade; also a short iron sword with a wooden hilt, in a good state of preservation. An iron stamp. Two perforated pieces of iron; a two-pronged iron tool like a fork; a pair of pincers (probably tools used in the foundry).

'The objects made of glass found here are eleven bottoms of goblets, and one smooth glass slab: these things seem to belong to a later age.

'Neither tools, weapons, nor, in fact, any other objects made out of organic material, have as yet been found here. While in other stations a number of tools, such as pins, haftings, and hammers, have been met with, all made out of bone or horn, not a single specimen of the kind has hitherto been found at Unter Uhldingen. On the other hand, bones, teeth, and horns unworked occurred here; in fact, of the same species of animals as are found at Nussdorf and Maurach. We may also mention some vertebræ of the bos primigenius, determined by Dr. Ecker of Freiburg.

'II. The lake dwellings of Sipplingen, which were discovered in the winter of 1864–5, are situated on the shore of the village

of Sipplingen, about an hour's walk north-west of Ueberlingen. They probably extend over twenty-three acres, and the number of piles may be 40,000 or 50,000. The distance from shore is from 1,200 to 1,500 feet. These settlements are in every respect like those of Unter Uhldingen, but the masses of stones are so much scattered that they cannot be divided into separate hillocks.

'The following are the specimens found here:—

'The objects made out of stone agree exactly with those of Unter Uhldingen. We may, however, especially mention ten flint arrow and lance-heads, one of which is very large (Plate XXVIII. fig. 33). A flint saw-plate like that found at Nussdorf and drawn Plate XXVII. fig. 20. With these flint implements a great lance-head of serpentine was found: it is drawn Plate XXVIII. fig. 3. Two hundred specimens of unperforated stone celts were found here, amongst them some specimens as large as those of Unter Uhldingen; two of them were hafted in stag's horn. Twenty perforated stone hammers, some perfect, others imperfect. One specimen of an unfinished hammer deserves mention: the helve-hole is not bored through but it has been drilled on both sides about a quarter of the thickness. A projection remains standing in the middle of each hollow (Plate XXVIII. fig. 2). It is evident from this that the hammers were not drilled till after they had been formed into shape. We may also mention eight specimens like chisels (nephrite ?).

'As usual, corn-crushers, hurling-stones, net-sinkers, mealing-stones, and grinding-stones were met with, as in other stations.

'A hundred specimens of stone implements, the use of which has not been decided, were found together in a heap. They are stones artificially worked into the shape of a cylinder, a plug, or an egg; they are rather long, ground and rounded off without corners or angles, and one end is generally broader than the other. We cannot make out with certainty the use to which they were applied, but, according to our own ideas, they are unfinished stone celts, which they resemble both in size and shape. If the broader end were ground down to a cutting edge, they would become the regular stone celts. If this view be correct, we gain a further hint how the celts were made, for the cutting edge would not be made till the stone had received the general form of the implement (Plate XXVIII. fig. 4).

'The objects made of clay are in general like those of Unter Uhldingen. The following may be mentioned as good and perfect specimens. Two jars with handles (Plate XXX. figs. 11

and 12). Some dishes or pipkins (Fig. 13 and Plate XXXI. fig. 4), amongst which is one with the base formed of a flat circular projecting portion, Fig. 8. Several cups or bowls, Fig. 7. Some vases (Plate XXX. figs. 1 and 10); also a wide funnel-shaped vessel (Fig. 14), and a large kind of jar with the base perforated like a sieve (Plate XXXI. fig. 5), and a crucible. In some of the vessels there were the remains of plants, which are not to be considered as the relics of food, but rather the chance lake-weeds which had got into them. Besides these vessels, which were got up more or less perfect, forty fragments of pottery were secured, also some net-sinkers made of clay, and a mould, and, lastly, some specimens of earthenware, the use of which has not been determined (Plate XXX. fig. 3).

'No bronze implements have as yet been found at Sipplingen. One single celt was met with made of copper, of very simple form like that of the stone celts; it has neither flanges nor ridges for the shaft. It was found embedded in a coating of clay (mould?) (Plate XXIX. fig. 19).

'The iron implements of this settlement consist of one lance-point, three arrow-heads, two sickles, one one-edged sword, two pieces of iron of a cylindrical shape, and one Roman key (Plate XXVIII. fig 28).

'Five pieces of grey-coloured glass were found here, all covered with little wart-like projections.

'Bones, horns, and teeth occurred here as at Unter Uhldingen; also vertebræ, and very perfect horns of bos primigenius. A human parietal bone is unique in the settlements of the lake of Constance.

'Sipplingen is rich in implements made of horn and teeth: we may mention an arrow-head of stag's horn. Eighteen ground stag's horn haftings, four cornered; some only of them were perfect (Plate XXVII. fig. 16). Eight similar haftings, but with the root or lower part cut into two prongs (Plate XXVIII. fig. 22). Twelve stag's horn haftings of a cylindrical shape. Eight pieces of stag's horn hollowed out to make haftings. Five bone pins. One hammer of stag's horn. One perforated bear's tooth, like those found at Nussdorf. Lastly, some implements of stag's horn ground to a point.

'The whole of the antiquities above described have been bought by the Würtemberg Government, and are now at Stuttgard.

'TABLE I. COMPARATIVE VIEW OF THE LAKE DWELLINGS ON THE EASTERN SHORE OF THE UEBERLINGER SEE.

	Nussdorf.	Maurach.	Unter Uhldingen.	Sipplingen.
Time of discovery . .	Winter 1862-3	Winter 1862-3	Late in 1864	Winter 1864-5
Area in acres . . .	3	8	10	25
Number of piles . .	3,000	5,000	10,000	40,000
Distance from shore .	50 feet	10 feet	1,000 feet	1,500 feet
Nature of the ground	Sand and clay relic-bed	Clay, relic-bed destroyed	Sand and clay 'steinbergs'	Relic-bed wanting
Materials of the antiquities	Stone, clay, bone, horn, and teeth.	Stone, bone, horn, teeth, amber, copper.	Stone, clay, bronze, iron, glass.	Stone, clay, bone, horns, teeth, copper, iron, glass.

'TABLE II. NUMBER OF ANTIQUITIES FOUND (AT A ROUGH ESTIMATE).

Specimens made of	Nussdorf.	Maurach.	Unter Uhldingen.	Sipplingen.	Total.	Remarks.
Stone	1,100	500	400	350	2,350	The majority ($\frac{5}{8}$) wedge-shaped celts. 400 imperfect specimens.
Bronze	...	...	200	...	200	
Copper	...	1	...	1	2	
Iron	...	...	40	16	56	
Glass	...	...	40	8	48	
Clay	40	...	180	60	280	Greater part ($\frac{2}{3}$) are in fragments.
Amber	...	1	...	...	1	
Organic material . .	700	...	...	100	800	
Number of specimens in the different settlements	1,840	502	860	535	3,737	

'Ueberlingen: December 1865.'

Since the above report was written, the weather during the rest of the winter has been extremely favourable, and the level of the water in the Ueberlinger See more than usually low, so that very many antiquities have been obtained from the various settlements in this lake.

LAKE OF ZUG.

Four, if not six, lake dwellings are now known on the banks of this lake. We will first give an account of the one found near the town of this name.

I. ZUG.

The discovery of this settlement, to the north of the town of Zug, was made by Professor Mühlberg, and it is of peculiar interest, as it has an especial bearing on the primæval history of the interior cantons of Switzerland. The view was formerly entertained that no trace of any permanent settlement in prehistoric times was to be found in these valleys; no Celtic settlements, and no graves or tumuli of this period have hitherto been discovered in this district, but only some chance stone and bronze implements, so that the only indications remaining of an earlier population were, till lately, the names of a number of places and mountains quite identical with some in the Rhætian valleys (Grisons and Tyrol). This led to the supposition that at some former period Rhætian races inhabited the whole mountainous district of the Alps; and now the very early existence of the human race in the inner parts of Switzerland is proved to a certainty by the discovery of a settlement which is exactly of the same nature as the lake dwellings of the stone age discovered in the lower parts of Switzerland.

The report given by Professor Mühlberg is in substance as follows. At the farther end of the upper row of houses in the suburb of Zug towards Cham, on the site of the modern hotel called the Keltenhof, Mr. Brandenberg, in excavating for the foundations of a new building, came, at a depth of about five feet, upon a black bed of decayed organic matter. Nearly at the top of it he found two stone implements, and also the perfect under-jaw of a peat boar. Attention was immediately directed to the place, and when the existence of a lake dwelling here was proved, arrangements were made for preserving every object of interest, and funds for this object were granted by

the town-council. The collection, now in the college, is by no means unimportant; it may be classed under three heads: remains of plants, of animals, and of stone.

Amongst the vegetable remains, the piles found here take the first place. They are from three to five inches in diameter and from three to five feet in length, and consist of different kinds of wood. Those of the hard brown oak are still in fair preservation, and tolerably hard; the majority, however, of the piles are of fir-wood, and are very soft and spongy, offering no obstacle to the use of the spade and often quite penetrated by the roots of water-plants. As the piles are round or unhewn, and for the most part still have the bark on, it is easy to distinguish those of alder, willow, birch, and hazel. Some of the piles were quite perfect, and it appears from them that the lower ends had been sharpened by means of fire. The piles reached down to, and had been driven into, a whitish granular strong muddy mass, probably the ancient bed of the lake; the upper parts went through a peculiar black bed, from seven to ten inches thick, consisting of nothing but decayed animal remains and plants, especially twigs and leaves. The heads of the piles were all on a level, and in some places they still had the horizontal beams lying upon them, consisting partly of natural stems and partly of trunks of oak or fir split in two. The black bed was the locality where all the antiquities were found. There was a large quantity of charcoal, proving that the settlement was destroyed by fire. Great quantities of hazel-nuts, chiefly cracked, were discovered, also beech-nuts and apple-cores, but no grains of corn or flax.

Only the most perfect of the animal remains were kept—numbers of broken bones of the extremities were thrown away; most of them, as well as the remains of vegetable food before mentioned, were found heaped together in one place—a voucher for the fact, already proved in other settlements, that these remains are nothing else but the refuse from the kitchens of the lake colonies. The bones, jaws, and teeth, belong chiefly to the red deer, the marsh swine, and the marsh cow. Remains of the roe, the horse, the domestic dog, and probably also of the sheep, were also met with.

With respect to the stone implements, they consist of two very different kinds of material. A few lance-points and one knife were of flint. It may not be out of place here to mention (though not actually found in the lake dwelling) that in 1843 a flint arrow-head with its wooden shaft was found on the Zug

mountain in what is called the Moor of Geissboden; it may probably date from the time of the lake dwellings.* The greater number of the implements, however, consist of serpentine; many well-ground celts of this material were found, and many more unfinished ones or fragments, as well as the raw material in different stages of working. It is very clear from these specimens that the stones were sawn half through with another hard sharp stone and then broken, and the fragments thus obtained could afterwards readily be ground to the required form (see Plate XXI. fig. 5). One fragment ought to be mentioned: it is that of a small stone celt, and consists of a clear green slate (nephrite?).

No implements of bronze or iron were discovered, nor any pottery.

From what has been said, this lake dwelling apparently belongs to the stone age; but this cannot yet be affirmed with positive certainty, for only a small portion of the settlement has been uncovered or could be examined. It clearly extends a considerable distance in some directions, for what evidently was a continuation of it was found some years since (before attention was particularly called to the subject) about 100 paces farther towards Cham on one side and also 100 paces towards the town on the other, and celts of serpentine were found there exactly similar to those lately discovered; and since attention was called to this settlement other stone celts have been found in these localities. Subsequent investigations, however, seem to show that it has not extended farther landwards.

Professor Mühlberg calls attention to one specimen differing essentially from the others in being of a yellowish white colour and in being less hard; he considers this celt to be of serpentine altered by heat; and with a view of testing this opinion he exposed in his laboratory a fragment of the raw material used for celts to a strong heat for a length of time. Before the experiment it was dark-green and as hard as fluor-spar, but afterwards it became of a dirty yellowish white, friable and soft. Consequently this is another proof that the lake dwelling at Zug was destroyed by fire.

The Professor's report then proceeds to give some particulars as to the nature of the ground where the lake dwelling was found. The space excavated was 40 feet long and 30 feet broad. It is on the right hand of the road leading to Cham, and close

* Of this arrow-head with part of the attached shaft two views are given, Plate XXXIX. fig. 15. The mode of attachment is well shown. The flint arrow-head is precisely like those found in the lake dwellings.

to it. This road is about 60 feet distant from the lake, and is 15 feet higher than the level of the water. The excavation is 5 feet deep in front but 6 feet behind, as the ground rises toward Baar. Four different beds may be distinguished; the upper one is of common mould 2½ feet thick, under which there is a bed of sand and rolled stones 1½ foot thick, followed by the 'relic-bed' very distinctly marked and from 8 inches to a foot in thickness. It is in this bed that the piles are found, but their lower ends go deeply into the fourth or lowest bed, which very probably is to be considered as the ancient bed of the lake, as it contains numerous shells of the small lake snails and also of the bivalve freshwater muscle. All these beds are inclined about three degrees towards the lake. It may thus be considered certain that in ancient times this settlement stood in the lake, or, to speak more correctly, that the lake extended formerly, as tradition says, much farther inland than at present. The fact of the present shore being so distant from the locality where these remains were found, may be explained partly by the bed or outlet of the river Lorze at Cham having been several times deepened, which of course lowered the level of the water in the lake, and partly by the great deposits on the plain of Baar brought down by the mountain torrents, and chiefly by the Lorze itself. This supposition is confirmed by the great fall of the Lorze from Ægeri to Baar (nearly 1,000 feet), and by the general agreement of the gravel brought down with the mass of stones in the deep gorge above Baar called Lorzetobel. Yet nothing is known of any diluvial action on so great a scale either in historic times or by tradition.

The animal remains were sent to Professor Rütimeyer for examination. He reported that some few of the bones were quite of a different colour and condition from the others, and ought entirely to be left out of the calculation, being probably chance additions. The remainder, though decidedly of interest by enabling us to draw a parallel in some measure with other localities, were, he considered, too small in number to warrant a general conclusion as to the fauna at the time of this lake settlement.

He states that the bones sent to him belong to the following animals, and he arranges the list under numbers, the earlier of which indicate those species found more plentifully in the small collection.

1. Cow. These remains belong entirely to the small domestic animal hitherto found as the prevailing form in every

'lake dwelling, and which is called by Professor Rütimeyer the marsh cow, and considered by him as the original stock of the grey or brown race of cows, chiefly of small size, now spread through the whole chain of the Alps. The perfect metatarsal and metacarpal bones leave no doubt about this. The under-jaws are of less value, as they belong to young animals and still contain the milk-teeth. 2. Red deer, not different from those of the present day. 3. Marsh swine. All the specimens of swine's bones belong without doubt to the small race called by Professor Rütimeyer the marsh swine, the size of which was decidedly less than that of the wild boar of the present day, and which in many other respects also differs from it. The remains of this animal gave the Professor the impression that it was in a wild state, but the small number of specimens would not allow of any certain decision on this point.

There is only one single bone of each of the other species. 4. Roebuck. 5. Horse. 6. Domestic dog: only a piece of the radius, which affords but small ground for determination; but as far as size is concerned there is no difference from the race exclusively found in the dwellings of the stone age designated by Professor Rütimeyer the marsh dog. 7. Hare. It is uncertain whether the upper part of the femur found here really is of the age of the lake dwelling, as its colour is different from that of the other bones, and it has a more recent appearance. Till lately, no remains of the hare have ever been met with, and more accurate information as to where this little piece was found would be highly desirable. Lastly, some remains of the pig and the sheep have quite a recent appearance.

Professor Rütimeyer concludes his report on these animal remains nearly in the following words:—'You will see from this short list that it is very far from affording anything like a safe comparison with that of other lake dwellings. The most important point in it, is the positive determination of the marsh swine: it is much to be desired that further remains of this animal may be found, which would enable us to determine with certainty whether it was the wild or the domestic animal; and further excavations would doubtless be of great importance on account of the excellent state of preservation of the bones, for amongst so small a number I have never seen so many perfect ones, or at least so many that were but little damaged. In the meantime, I must return to my first view, which leads me to place the age of this settlement about that of Wauwyl and Robenhausen, unless, indeed, future discoveries modify

this opinion; but probably the additional evidence of the artificial products leaves no doubt on the point.

Plate XXI. fig. 1 gives a section of the locality excavated in the lake dwelling of Zug; Fig. 2 shows the ground plan; Fig. 3, celt of serpentine; Fig. 5 is a piece of serpentine partially sawn through in two places, preparatory to being made into three celts; Fig. 4 is a flint arrow-head.

II. KOLLER.

In the summer of 1863, Mr. Schwerzmann of Zug, when making a ditch alongside of the line of the railway, noticed fragments of pottery which were thrown out with the earth; Mr. Staub, the Prefect, to whom he mentioned this fact, went several times to the place, and 'I accompanied him,' says Professor Mühlberg, 'to aid in the search for antiquities. The locality is close to the line of railway from Zug to Cham, in fact, within the triangle made in the low ground west of the Lorze by the lines of the Zurich, Zug, and Lucerne railways. We examined the ditch, and made a small excavation, and we were rewarded by a whole basketful of fragments of pottery made out of fine grey clay, but badly burnt; with a single exception, they were all portions of vessels with a great bulge. No tools of stone or metal were met with, except some bits of waste celts of serpentine. We also found charcoal, hazel-nuts, and some bones. The relic-bed is not thick. The following is the succession of the various deposits: at the top the marshy ground is half a foot thick; then comes loam or clay 2½ feet in thickness. Below this is the relic-bed, the thickness of which is uncertain, lying upon the white lake bottom or shell-marl. It is in this last bed that the piles are found standing here and there, and on these rest cross-timbers of oak. From the small extent of our excavation it was impossible to determine exactly the arrangement and distribution of the piles, yet so far seems certain, that the piles run parallel with the shore. If excavations were made within the above-mentioned triangle, and no remains were discovered there, it would be proved that the settlement extended from the south line of railway down to the lake. Very singularly, the present level of the water is three feet under that of the relic-bed.

III. ST. ANDREAS NEAR CHAM.

The picturesque little castle of St. Andreas is situated on a small rise east of Cham, near the lake. Not far from it, in a north-easterly direction, the countrymen, when tilling their lands in the low grounds, had for some time past found stones ground into the shape of hatchets, but after exciting a little wonder they had always been thrown away. In consequence, however, of the discovery of the lake dwelling at Zug, these stones began to be regarded with more attention, and were preserved when found. When these facts came to the knowledge of Mr. Staub and myself, we went over to the locality in the summer of 1863, and were fortunate enough, by simply walking over the fields, to fill our pockets with as many stone celts as we could carry home. A short time afterwards the owner of the property sent to Mr. Staub, who is the prefect of the place, a whole basketful of stone celts. This discovery incited us to excavate in the following autumn. A trench was made from the lake nearly to the line of the railway, and also a smaller trench at right angles. The result, however, was not of much importance. All that we obtained from the excavation consisted of a few stone celts and the positive proof of the existence of piles; they were from three and a half to six inches in diameter, but were not very numerous. We found no piles in the lower part of the trench, and we consequently concluded that the settlement did not extend to the present bank of the lake, but probably went farther landwards from the place which we excavated. The shell-marl or the ancient lake bottom here was only half a foot beneath the surface. No actual relic-bed was to be seen; or, to speak more correctly, the tillage-ground, half a foot thick, was the ancient relic-bed. The celts which were in the bed above the shell-marl were brought to light by the plough or by digging up the produce of the land, while pottery was destroyed, and everything else which was very fragile. The specimens found at this station were consequently only piles and stone implements.

The stone implements found here may be divided into three classes, according to their shape and material.

1. Implements made of erratic pebbles and blocks. By far the greater number of the implements found here belong to this class. They are celts of various forms and sizes, from $\frac{1}{2}$ inch to $2\frac{1}{3}$ inches broad, from $1\frac{1}{2}$ line to $2\frac{1}{3}$ inches thick, the shape being either

triangular, long quadrangular, or elliptical, and the section being either rectangular or elliptical. All of them were ground sharp at one end, while the other is either truncated or rounded off in a conical form. In every case the workmanship is rude. While all the celts from the lake dwelling at Zug were carefully rubbed down and smoothed on every side, those found here were only polished on the surface of the cutting edge. The material was taken from some of the numerous erratic blocks lying about, and consequently their composition is just as varied. In general, the kinds of stone which are of the nature of limestone or coarse-grained varieties of granite and gneiss were rejected, and those were chosen in preference which are fine-grained, compact, and hard from being of a flinty nature. Some specimens, however, were met with of very coarse gneiss, containing a quantity of epidote, which naturally could neither be well worked nor brought to a fine edge. Very many consist of a kind of serpentine, which does not occur in erratic blocks in the canton of Zug, and these specimens were the best both in shape and workmanship. One single celt reminds us of the nature of what is called the Julier granite, and we are tempted to believe that the material out of which it was made was brought from the Julier pass or from the Grisons, and that the serpentine out of which the other celts were manufactured came from the same district. Another specimen consists of talco-quartzite, of which numerous blocks are to be found in the eastern part of the canton, being in fact erratics from the canton of Glarus. The erratics of the plain brought down by the glaciers of the valley of the Reuss, are of the kinds of stone found *in situ* in the canton of Uri, and the material of the celts so completely agrees with them that we may often fancy the block may be recognised from which this or that specimen was struck off.

2. Implements of flint. The fragment of a lance-head, and also many waste flakes of the same material.

3. Implements of limestone (Plate XXII. figs. 13 and 14). These tools are rather long and flat, with a short neck, perforated for the sake of being worn or hung up. In one specimen (Fig. 14), after the handle had been broken off near the hole, a second perforation was made, and it was again used, notwithstanding its being imperfect—a proof that the thing was of some importance either as an ornament or an amulet.

IV. DERSCHBACH.

Having repeatedly heard that stone celts had been found between Buonas and Cham, on the west side of the lake of Zug, I examined the flat shore of that neighbourhood, and actually found a stone celt on the foot-road leading from the houses of Derschbach to the fishermen's huts on the bank of the lake. We may therefore safely assume that a lake dwelling existed here; but it can only be thoroughly examined by means of an excavation.

V. AND VI. ZWEIEREN AND AT THE BATHING-PLACE AT ZUG.

These two localities have been mentioned to me provisionally as lake dwellings by an indirect communication, but I have no reason to doubt of the correctness of this information.

In conclusion, I would call attention to the interesting fact, that all the lake dwellings hitherto discovered on the lake of Zug are situated somewhat inland. On this account it has been supposed that they stood originally not in, but on the banks of the lake. This view, however, is shown to be incorrect, as the relic-bed everywhere rests upon shell-marl (Seekreide); we must therefore conclude, as I have previously mentioned, that the level of the lake in early ages was considerably higher than at present, and that the water in those times extended so far over the present land as to make the modern shore covered to some depth with the waters of the lake. The lake dwelling of Cham is a proof of the correctness of this view, as the lower part of it does not extend to the present shore. Apparently the lake was lowered by the deepening of the channel of the river Lorze, which flows out of it. The relic-beds of the different settlements in consequence lie on dry ground, and are found under a thin covering of vegetable mould, or of gravel brought down by the mountain streams.

Plate XXII. figs. 2 and 3. Vessels found at Zug of a grey colour, made of purified clay. The shape of Fig. 2, and the 'meander' pattern on Fig. 3, indicate a later period and more advanced civilisation; they do not belong to the actual stone period, but to the bronze age.

NIDAU-STEINBERG.

This station was the earliest of its kind which was investigated, and it deserves especial attention, not only on this account, but from the mixed character of the antiquities found here, which belong to the stone, the bronze, and even the iron age.

The name of Steinberg has from olden time been borne by a shallow in the lake of Bienne some hundred feet distant from the place where the river Zihl flows out of the lake by several channels. The depth of this lake at its lower or north-western part, when the water is of an average height, does not exceed 18 or 20 feet; and the Steinberg is a hillock rising gradually from the bottom. Its superficial area is about 2½ or 3½ acres; its actual summit is usually covered with 7 or 8 feet of water. On the south side, towards Nidau, the lake is of less depth than elsewhere in the shallow parts, so that the Steinberg is connected with the shore by an elevation of the lake bottom like a dam or bank. (See Plate XL. fig. 1.)

Steinberg takes its name from the fact that, while the bottom of the lake is almost everywhere covered with mud and loam several feet thick, this hillock consists of an accumulation of roundish stones. A closer examination of these stones shows that they are rounded rubble-stones, very nearly all of the same size, and consisting of quartz and granite; these are not in their original bed, but have evidently been collected with great care and labour from the heights above Nidau, where similar stones are found in profusion, and have been brought in boats to this part of the lake. This fact, which when Nidau-Steinberg was first examined appeared a singular assertion, is confirmed by what was found at the Island of St. Peter, which will be described in its proper place, as well as by the numerous instances of lake dwellings lately discovered, very many of which are placed on a Steinberg or stony hillock of similar construction under water.

As we have proof that the low ground below Nidau, together with that between the lakes of Bienne, Neuchâtel, and Murten, called the 'Great Moss,' was in former times inhabited, and the level of these lakes in early ages was considerably lower than at

present, it is in the highest degree probable that the upper part of the Steinberg was once very near the surface of the water, if it even did not rise above it, and, when the water was low, form a small island.

Another circumstance drew attention to the Steinberg quite as much as the mass of rolled stones, and this was the appearance of a series of piles, which originally seem to have occupied the whole of the summit, but now are only partially visible. When passing over the place in a boat, piles may still be seen standing, sometimes single, sometimes in straight or curved lines, and sometimes in groups; projecting two or three feet from the bottom on the highest part of the Steinberg and three or four feet at the sides where the water is deeper. As a great proportion of these piles have rotted away, or may be covered with mud, and a number of them have been pulled up by the boatmen, their original arrangement cannot now be ascertained, and their appearance to the eye is at the present moment that of a confused mass of dark points or dots. Where they are found together in the greatest numbers they stand from 1 foot to 3 feet apart. Most of them are whole trunks, only a few were made out of split stems; they are from 3 to 10 inches in diameter: they have been driven 2 or 3 feet deep into the bottom, and the lower ends were sharpened by fire. Most of the piles which have been drawn up consist of oak, beech, and fir. It is worthy of note that there are a considerable number of trunks found here lying horizontally, which evidently have not fallen down in this position by chance, but have been intentionally sunk to the bottom: some of them are squeezed in between the upright piles, and join each other at right angles, but the majority lie confusedly in all directions, and show very much less of an intentional arrangement than the upright ones.

It is singular that the actual importance of the Nidau-Steinberg was never known till after the discovery of the lake dwellings of Meilen. It is true that at different times a number of Roman tiles had been found some hundred paces from the Steinberg where the cut or canal from the Scheuss falls into the lake, and some fragments of the same kind had also been observed on the hillock of the Steinberg itself; and the neighbouring inhabitants consequently ascribed these piles to the Romans, and imagined that they formed the wooden foundation of a lighthouse or some fortified place; but they found it difficult to account for the total absence of mortar and hewn stone, and also for the length and slenderness of the piles.

The place, however, was examined by Mr. Müller of Nidau and Colonel Schwab of Bienne, who spared neither time nor trouble, and from their zealous and careful investigations we are now able to say with all certainty that a settlement existed in this place, bearing the greatest similarity to that of Meilen and numerous other lake dwellings since explored. It is really almost incomprehensible that the Steinberg, the place of all others in the lake of Bienne most frequented by fishermen, and where day by day a number of small barks are stationed, should now for the first time appear as one of the richest localities for prehistoric antiquities, and afford such a number of beautiful and remarkable bronze remains as are to be seen in the antiquarian collections of Mr. Müller and Colonel Schwab.* Hidden by a coating of calcareous matter, they have for centuries escaped the notice of the fishermen who carried on their daily occupations above them, and till a short time ago they remained entirely unnoticed. But now, to the initiated eye, the piles appear as the substructure of the lake dwelling; the wood which, either burnt or half-burnt, lies about in great abundance on the bottom is recognised as the remains of former huts; the large number of fragments of pottery found in the mud as broken ancient vessels; and what appeared to be stones of a strange form turn out to be bronze hatchets and lance-points; nay, even many of the roundish rubble-stones most extraordinarily are found to have been used as implements in the most remote ages.

The drawings and descriptions of the objects found at Nidau will show that it was a flourishing station throughout all periods, from the stone age downwards. Many objects of stone, bone, and pottery which have been obtained there, and which mark the commencement of the civilisation of man in our districts, show that it was a settlement in the earliest period; but its existence was prolonged up to the time when bronze was commonly employed for implements; nay, it even outlasted this period, and reached that when iron came into use. Here and there on the same lake bottom works of art are found lying close together, betokening very different grades of civilisation, and telling us of centuries lying far apart. The Nidau lake dwelling therefore coincides, on the one hand, with the settlements of East Switzerland which ceased to exist before the bronze age or at the very beginning of it, and, on the other hand, its existence runs parallel

* These two collections are now united in the Museum of Colonel Schwab.

with those of West Switzerland which were first founded or came to their full development in the course of this period, and from which have been obtained such a great number and variety of bronze implements used for war, for household purposes, or for ornament.

We will now describe some of the most interesting antiquities found in this settlement.

I. OBJECTS OF STONE.

Many stones of different sizes and of various descriptions were found here which had been perforated and used for sinking the nets. Some of the largest weighed five or six pounds, and were made out of roundish rolled stones surrounded by an iron hoop; and in order to keep this firm, a kind of hollow or furrow had been made all round the middle of the stone (Plate XXXVIII. fig. 15). There may be a doubt as to these iron-hooped stones being of the same date as the other remains found in this settlement.

Several of the objects commonly called slingstones have been found here. These singular disk-shaped stones (drawn in section, Plate XXXVII. figs. 1, 2, and 3, and also Plate XXXVIII. figs. 1, 2, 3, 4, and 7) nearly all consist of yellowish or reddish quartz rock; they are circular, and have both sides flattened in general with a central depression: there is a groove round the edge, and they are ground or polished all over. They are from 4 to 5 inches in diameter and more than 2 inches thick. The central hollow varies in width from 1 inch 2 lines to 1 inch 8 lines, and is from 2 to 3 lines deep, and appears like a flat cup, the section forming the segment of a circle, as seen in the Figures 2, 3, 4, and 7, Plate XXXVIII. One of them, made of oolitic stone, is remarkable for its peculiar shape and excellent workmanship. These things, so similar to pulleys in form, evidently have had a great deal of labour bestowed upon them, and deserve the especial attention of antiquaries. Their true use, according to our opinion, has not yet been ascertained, and we call them 'slingstones' simply because this name has been given to them in works on archæology. It is not to be supposed that stones which required all the art of the workman to bring them into proper shape should have been slung away in battle like any common stone picked up on the surface of the ground. As the sling is always broader in the middle, in order to keep the projectile as in a hood or cap, the form of

these stones appears to make them totally unfit for the purpose assigned to them, besides which the grooves round the edge and the central depressions on the sides would be quite useless additions. Similar stone objects were found in the Celtic settlement of Ebersberg on the mainland. One of them is drawn Plate LXXXIX. fig. 1. It is remarkable that slingstones of the regular form have not yet been discovered in the older lake dwellings, but, on the contrary, a large number have been met with in the later settlements. Schoolcraft, in his 'History and Condition of the Indian Tribes of the United States' (Smithson. Instit. pt. i. p. 82), says that the game of stone-hurling is one of the most favourite of all amongst the wild tribes of North America. 'It is incredible with what accuracy the natives throw these stones to a given point. The number of disk-shaped stones which have been found in the tumuli and the ancient settlements show that this amusement was very common amongst the ancient races.* These old hurling-stones were made with great labour and skill out of very tough stone (porphyry). In the third part of this work Plate LIX. fig. 1 is the representation of a roundish stone with a furrow, which was in the museum at Albany, and was considered as "a war-club."' Sir W. R. Wilde, in his 'Catalogue of the Museum of the Royal Irish Academy,' p. 95, figures a somewhat similar stone (Fig. 77), and mentions the conjecture that it was 'one of what are called "flailstones," used in early Irish warfare, attached by a thong to a stick, and to which allusion is made in the account of the feats of the Ulster champion Cucullin.' At all events, the name of 'hurling-stone' or 'club-stone' is quite as suitable as the one hitherto used of slingstone.

The stones called corn-crushers were also made of hard stone —granite or quartz-rock—and only differ from what are called slingstones by being more spherical in form, and by having no groove at the side or edge; they are generally 3½ inches in diameter and 2½ inches thick. The depressions are wider than in the slingstone, and are made with less care; those found here are in general very similar to the two from Meilen, drawn Plate II. figs. 7 and 8, but some consist merely of cylindrical stones, and are only to be recognised as grinding or crushing implements by being truncated above and below, and by the

* A similar game appears to have been common amongst the ancient inhabitants of Cornwall. In the parish of St. Clere are three of the so-called Druidical circles, and the tradition is that the stones which form them were once men who were changed into stones as a punishment for 'hurling' on Sunday: they still go by the name of Hurlers ('Borlase,' p. 188.)—[Tr.]

surface being rough; some specimens also have hollows or slight depressions on the two opposite sides, to allow of them being held more firmly.

The 'mealing-stones' consist also of large unworked slabs of a hard kind of stone, but more tabular in form. On one of the two sides, and sometimes on both, roundish hollows have been made in the shape of the segment of a sphere, the diameter of which is some inches, and the depth varies from half an inch to an inch and a quarter. The surface of this cup is left rough; it was destined to receive the corn to be ground or crushed. The mealing-stone drawn Plate XXXVIII. fig. 5 (which was from Meilen) is precisely similar to those found at Nidau.

The sharpening-stones or whetstones found here are exactly like those found at Meilen, drawn Plate III. fig. 5, and, like them, they consist of fine-grained sandstone.

What may be called grinding or polishing-stones (Reibsteine) are of granite, and are perfectly smooth and well polished. They have just the appearance of the stones on which the painters of the present day grind their colours.

Plate XXXVII. fig. 25 is a small perforated stone. Fig. 29 is also a small stone perforated on the three sides to allow a cord to go through. Fig. 10 is a bowl turned out of potstone. This material was employed in our districts in very early times for several purposes, and especially for pots or vessels; it was especially in use on the south side of the Alps in Maggiathal, in the district of Lavizzara in the canton of Tessin (hence the name of Lavez-stone).* A small vessel with an iron rim and a handle, exactly like those now made, was found in a tumulus near Pfäffikon, in the canton of Zürich, opened in the year 1854, and together with it there were iron weapons and bronze ornaments. Many vessels of this kind of stone, beautifully worked, are in the collection of Colonel Schwab. Fig. 26 is a large bead made of serpentine. Fossils were also used as ornaments, such as terebratulæ, small ammonites, and plates or joints of encrinites; crystals and variegated pebbles are also found which had served the same purpose.

II. OBJECTS OF BRONZE.

The lake dwelling of Nidau is particularly rich in bronze remains. A large number of sickles have been found both at

* Lapis ollaris, lapis Comensis. (Pliny xxxvi. 22, edit. Dalecampii.) Vessels of this kind of stone are, however, not older than the early iron age.

Nidau and Lattringen, very similar to each other both in form and size. They are like a half-moon, but with this difference, one half is less curved and is rounded at the point, while the opposite end is somewhat wider. On an average, the length from one point to the other is 5½ inches; the breadth of perfect specimens in the middle is from 1½ to 1¾ inch. On one side they are quite flat, and on the other they have either one, two, or three ribs running parallel with the outer edge, partly for the sake of strength and partly for ornament. They were all cast, as may be clearly seen by a projection in the middle of the border; sometimes even a portion of the metal was left standing, indicating the channel for pouring in the liquid bronze. The mode in which they were hafted is exactly the same as that in the bronze celts: they were fastened into a piece of split wood by means of cord or a nail. A very large number of implements of this kind are in the most instructive cabinet of Colonel Schwab, and in other Swiss collections, and I can give my assurance that of all I have seen no two specimens have been cast from the same mould. Many of the sickles found at Nidau-Steinberg appear to have been exposed to a violent heat. Two of them are drawn Plate XXXIII. figs. 1 and 2.

The specimens of bronze celts found here are with a single exception of the same shape and nearly of the same size, from 5⅓ to 6½ inches long (Plate XXXV. fig. 5). Towards the lower part they all have a projecting ear or ring, and they have flanges at the sides which bend round in a half-circle and nearly touch each other. In many celts, especially the flatter kinds, may be noticed an incision or notch at the lower part (see the Transactions of our Society, vol. ii. part 7), into which a nail fitted, which prevented the celt from going back when a heavy blow was struck. This notch is not seen in the eared celts, and they have at this place a degree of unevenness which arises from the breaking off of the 'run' of metal, or what is called by workmen the 'gate.' There can be no doubt that a ring was attached to the ear, by means of which the celt was fastened to the handle.* ('Archæologia,' vol. xvi. Plate 54.) In a few specimens some slight degree of ornamentation is attempted, by having the sutures or places where the mould joins together on the sides raised so as to become ribs. In one single small specimen the cutting edge stands at right angles to the

* A celt obtained by M. Müller is especially worthy of attention, as it shows the mode of hafting, and actually contains the remains of its wooden handle. It was found in a tumulus on the mainland.

body and the ear of the tool, thus giving it the form of the cross axe, such as is used by boat-builders.

Many of the celts found here appear from several indications never to have been hafted, and consequently never to have been brought into use. It is also worthy of remark that two of them cannot be found which were made in the same mould—a fact which indicates a very large number of moulds, and also the wide-spread use of these implements.

The admirable collection of Colonel Schwab is extremely rich in bronze knives, most of which were found at the Nidau-Steinberg. The shape of these knives is on the whole exactly like that of the bronze knives found in other European countries: the blades are from 3½ to 7½ inches long, and from about ½ inch to 1 inch broad; like the sickles, they are flat on one side, while on the other they are sloped like a razor, and are generally ornamented on this side with ribs which run parallel with the back. There are different kinds of handles; either the blade and handle were both cast in one piece (for all the knives were cast), or the knife was fixed, as is now the custom, with a spike (or what workmen call a 'sturt') into the handle, or instead of the spike it had a socket, into which the handle was fastened. Plate XXXIII. fig. 5 is an example of the first kind, and it is further remarkable for uniting in itself the ornaments usually found on several other implements, and which belong to the most superior products of Celtic art. Thus, the lower part of the handle is bifurcated like the hilts of many bronze swords; the upper part of the handle is ornamented like the sockets or barrels of the lance-heads, and the blade has ridges running along it like the ornaments on one side of the sickles. Figs. 3, 4, and 6 are specimens of the other descriptions of knives.

Fig. 10 seems to have been at the same time both an awl and a knife.

All the specimens of spear and javelin-heads found at Nidau are of excellent workmanship and form; probably they indicate the proficiency made by the colonists in casting, more than any other of the bronze implements. The length of these points or heads varies from 3½ to 13 inches, so that the smaller ones probably belonged to arrows or javelins, and the larger ones to spears or lances. Even if we imagine that the same implements were used both for war and the chase, yet in all probability those which had a long socket richly ornamented were chiefly used for warlike purposes. The weapon drawn

Plate XXXV. fig. 3, is remarkable not only for the rings, both plain and indented, which run round the socket, but also for the serpentine ornamentation with which it is covered.

Plate XXXV. fig. 4 and Plate XXXIII. figs. 12 and 13 are other specimens of these spear and arrow-heads.

Some smaller barbed arrow-heads are represented Plate XXXV. figs. 10, 11, 12.

Several sizes of bronze chisels have been found here. A broad chisel is drawn Plate XXXV. fig. 6. It is four inches long, is made with a socket, and the cutting edge has a sweep like that of a celt. The narrow chisels found at the Steinberg are, as far as I know, the only tools of this kind found in Switzerland. Drawings of two varieties are given, Plate XXXIII. figs. 7 and 8. Even these narrow chisels have sockets.*

Fig. 9 was at first considered as a kind of hammer, but it is now thought probable that it may be one of the anvils on which the swords, sickles, and knives were sharpened by beating. It has six sides and has a cavity in the centre. The Fig. 9A shows the upper view.

A very large number of pins, either for the hair or for fastening the clothes, were found at Nidau. A selection from them will be found Plate XXXIII. fig. 11, and Plate XXXIV. figs. 1 to 34. Some of the heads of these pins were hollow, and, as is mentioned elsewhere, little balls of lead or stones of a reddish colour were set in them. Similar pins are found in the Swiss tumuli.

Several needles, or at least similar implements, fitted for sewing, knitting, or what is now called crochet-work, are drawn Plate XXXVI. figs. 6 to 18.

Figs. 1 and 2 have a little chisel at one end, and a piercer at the other.

Fig. 3 appears to be a drill, which was fixed into the turning-machine by its upper or broader end.

Fig. 4. Surgical (?) instrument, curved and flat at the top (see the upper figure), bent round at the bottom, with a cutting edge directed outwards.

Fig. 5. A small shovel-shaped instrument or ligula; the figure to the left at the top shows the section.

The armlets drawn Plate XXXV. figs. 1 and 2, resemble hollow rings of which a portion has been removed: they are amongst the most singular of the Celtic articles of the toilet. They are smooth inside, but on the outside they are richly

* See Arch. Journal, 1852, p. 303.

adorned with impressed and engraved ornaments. They sensibly diminish in size towards the two ends, which are bent round into semicircular appendages. Their internal diameter is from 3 to 4 inches, their breadth from 7 lines to 1½ inch; the thickness of the metal plate is hardly a line. Two other armlets are drawn on a smaller scale (Plate XXXVII. figs. 34 and 35). The first of these is so thick that it would have been very inconvenient for the purpose usually assigned to them, and the same remark will apply to the armlet of which a portion is drawn Plate XXXIV. fig. 36; it is made of solid cast bronze, and is flat on the inside.* Fig. 35 is a smaller armlet, made of twisted bronze wire.

Rings made out of thin bronze wire, and from 2½ to 3½ inches in diameter, with hooks fixed to them, are considered as earrings.

A great variety of solid rings were met with; some of them made out of thick wire, such as those drawn Plate XXXIII. figs. 15 and 16, both of which have appendages, one a smaller ring, and the other a short rod; others were cast, such as those drawn Plate XXXVI. figs. 33 to 41. The very curious set of rings (Fig. 36) was not made by the smaller rings being bent round the larger one, but the whole was made by casting in a mould.

Plate XXXVI. figs. 19 to 32, represent a series of fish-hooks of various forms and sizes, some with and some without barbs, and with the shanks either bent round or notched. The section of the wire is in most cases quadrangular; not a single one has it perfectly round and uniform. These hooks are exactly like those found in the Celtic settlement of Hallstadt in Upper Austria.

Plate XXXIV. fig. 37 is a hook, the use of which is unknown.

The knob drawn Plate XXXIII. fig. 14, is provided with a socket; it may have formed the end of a knife-handle, or it may have been the bottom of the shaft of a lance.

Plate XXXV. figs. 13 to 24 are cutting implements of various kinds made of cast bronze. In Figs. 13 to 20 the back is nearly ⅛ of a line thick. Some of them are perforated or have rings, and seem as if intended to be worn (Figs. 15, 17, 18); others have ridges on one side like the sickles (Fig. 24), and

* Some of the armlets, or 'manillas' as they are called, manufactured at Birmingham of solid brass, and sent out as an article of trade, almost by tons, to the wild tribes on the coast of Africa, are in fact heavier than most of the armlets from the lake dwellings. They are used by being clasped round a black lady's wrist, then hammered till the ends meet, and thus remain to her dying day.—[Tr.]

again others are ornamented with engraved lines like Fig. 23. The Figs. 16, 20, 21, and 22 nearly have the form of knives.

Figs. 8, 25, 26, and 27 are knobs of various kinds. Figs. 7 and 9 appear to be ornaments.

Fig. 30 is a specimen, the use of which is unknown; it has two truncated horns, and may possibly be allied to the moon-images.

Fig. 29 is a spiral made of bronze wire; the section of the wire is like that of an early crescent moon.

Plate XXXVII. fig. 32 is a piece of bronze wire, wound round into a kind of spiral form at each end.

Fig. 33. Bronze implement of the size and shape of a snaffle-bit, and which probably was used as such.

Fig. 5 is a bronze hammer with an ear.

III. OBJECTS OF GOLD.

Plate XXXV. fig. 28 is a spiral of gold wire, square in the section, first twisted round on itself and afterwards coiled into a spiral form.

Plate XXXVI. fig. 42 is a gold plate, ribbed, or, in modern language, corrugated.

IV. OBJECTS OF IRON.

Iron spear or javelin-heads, more than 6 inches long, have been found here similar to those drawn Plate XLII. fig. 2 from Sutz; they are made out of iron plate bent round so as to allow of their being fastened to shafts. The iron hoop on the large net-weight, drawn Plate XXXVIII. fig. 15, has already been mentioned. It is certain that these objects do not date from the same period as the bronze implements.

Another specimen made of iron was found at Nidau, which has unfortunately been drawn amongst the Marin antiquities (Plate LXXXI. fig. 3 and fig 6, section). It consists of two curved plates of iron holding a piece of wood between them by rivets.

V. OBJECTS OF CLAY.

The remarks which were made respecting the pottery at Meilen equally apply in general, both as to form and material, to that found at Nidau-Steinberg, the settlements near

Lattringen, Möringen, &c. At Nidau and Lattringen the works of the potter are found in great abundance and variety of form, and many of them have been so well preserved that without much trouble they can be arranged in regular classes, and we are able to get a pretty clear idea of the uses to which they were applied and also of the degree of artistic skill attained by the workman.

From the specimens which have been found here, we may also be very certain that the whole of them were made by the hand alone, and that the potter's wheel was not used. They have also been made of similar material to that of the pottery from other stations, but with this difference: the clay, which was used unwashed, has been mixed up, not with gravel or granite-grains, but with charcoal-dust or pieces, some of them of the size of millet-seed, and in such quantities as to give a dark-grey colour to the mass. Lastly, they were burnt, ornamented, and painted in the same manner. Some vessels were found here of extraordinary size, the mouth being three feet across, which may have been used for storing up corn and other things. The smaller vessels appear to have been intended for the reception of fluids, and also for cooking. Then we have dishes, basins, bowls, and drinking-cups of very different forms and sizes. As these vessels agree in every respect with those found in the tumuli (described in vol. iii. of the Transactions of the Antiquarian Association of Zürich), we must refer to what was then said as to the different sorts and the uses to which they were applied; but we will select from the row of vessels now standing before us certain specimens for closer examination.

With respect to the largest, of which, unfortunately, only a fragment has been preserved, the question arises in the mind of everyone who sees it what possible means there were for making a vessel of such a size, and so regularly formed and with such thin sides or walls, and how it could have been burnt without the use of a close fire. According to my notion, the correct answer to this question is given in the accounts of the earlier travellers, who describe the mode in which earthenware vessels, just as large as this one, are made by people in a similar state of civilisation to that of the inhabitants of our lake dwellings. The Arrowaks, the ancient inhabitants of Jugana, according to the account given by Davies (p. 263), make their earthenware vessels in the following manner: 'When they commence a vessel, after having mixed the clay with powdered

charcoal, they make first a round disk or slab, which always is very small even for large vessels; they then make of the same kind of clay small sausage-shaped strips about as thick as the finger, which are made to adhere to the under disk and pressed flat with the fingers. Thus they go on, till the vessel has become of the requisite size and shape. They make dishes in the same way, which are often so thin that it is marvellous how with the hand alone they are able to bring them to perfection and to give them such a regular form. In the course of the work, when the clay has become partially dry they polish it with a smooth stone. Most of these vessels are round at the bottom, so that they would not stand well on level ground, but would have to be placed on a foundation of sand. They often make water-vessels so large that a European potter could hardly manufacture them on the wheel; they also make excellent pipkins. When the vessel is sufficiently dry, and more especially if it is of large size, a hole is made in the sand, and brushwood or any kind of wood that burns easily is laid under and around it, and also some little inside if the sides are thick, and thus it becomes well burnt.' ('Neuwied,' ii. 127.) 'The North Americans also manufacture vessels of burnt clay like those found in abundance in their ancient burial-grounds; they are made of grey clay, and the surface is very much marked with rings.* Broken shells are found plentifully in the dark-grey material of these vessels.' ('Neuwied,' ii. 127.) 'The Maudans and other races manufacture earthen vessels of dark slate-coloured clay mixed with gravel and granite.' (Klemm's 'Cultur Geschichte,' Bd. iv.)

It is remarkable that, in the vessels found in the lake of Bienne the base is of very small diameter; sometimes, in fact, there is none at all. The drinking-vessels are almost always round, or made so that they will not stand on a level surface (Plate XXXVIII. figs. 6, 8, 9, 10, 11, 12 and 13). Some of the urn-shaped vessels are covered with a bright and beautiful black coating made by graphite, and yet they have the peculiarity of not soiling the hands when touched.

Plate XXXVII. figs 27, 27′, and 28 are earthenware vessels like plates, coloured red and black; they are exactly similar to

* Some fragments of pottery which had this peculiar style of ring ornamentation were exhibited at the last meeting of the British Association at Birmingham, by Principal Dawson. They were from Hochelaga, the ancient Indian settlement on the site of Montreal, which can be historically proved to have been abandoned by the native tribes 200 years ago.—[Tr.]

those found in the tumuli at Dörflingen and Trüllikon, both in material and also as to shape and ornamentation. (See the account of the Helvetian 'Heidengräber,' vol. iii., Plate V. fig. 5, and the general remarks upon them, page 77.) Fig. 30 is a double earthenware cup.

One vessel was found on the Steinberg perforated at the sides like some found at Ebersberg on the mainland and also in several lake dwellings. It is that drawn Fig. 6; it has several ornamental parallel lines encircling it like hoops, and the perforations above referred to have been made in these lines, and run in an oblique direction, as mentioned elsewhere; the use of these vessels is rather problematical, but they are commonly thought to have been intended for preparing cheese.*

Many of the earthenware vessels found at the Steinberg were filled with charcoal; others had been damaged by the fire when the settlement was burnt; some few pieces had been almost melted by the violent heat, and had doubled up or run together.

It is singular that the clay rings which are so very plentiful in the lakes of Bienne, Neuchâtel, and Geneva, were not found at Meilen. One of them from Nidau is drawn Plate XXXVIII. fig. 14. These rings are made of clay mixed with little stones and pieces of charcoal, but they are imperfectly burnt, and very little care has been bestowed upon them; they vary in external diameter from 3½ to 9½ inches; the hole in the middle is from 7 lines to 2½ inches wide, and the thickness of the ring itself varies from 1 inch to upwards of 2 inches. Various opinions have been expressed as to the use of these rings. The idea that they were net-weights is now abandoned. It seems now ascertained that they were used as supports for the vessels which either had no base at all or one so small that they would not stand. There can be no doubt also that they were used in a similar way as supports for pipkins with a conical base when placed on the hearth. Many of these rings appear to have become friable from the action of violent heat, but it is not always certain whether this happened on the hearth, or when the settlement was burnt down.

A considerable number of spindle-whorls are to be seen in the collections from this locality. The specimens drawn (Plate XXXVII. figs. 17 to 24, and Plate XXXVIII. fig. 17) will

* Mr. Müller informed me that at the present time similar vessels, though perhaps of larger size, are manufactured by the potters in the valleys of the Jura. They are used for separating the curdled part of the milk—the substance of the cheese—from the liquid part which runs off through the holes.

give some idea of the variety in form and ornamentation. Most of them are made of purified clay blackened with graphite and rubbed smooth. The fact of one side being always flat and without ornament prevents our considering these things as beads. English antiquaries consider the little disks of earthenware slightly raised, which are so commonly met with, to be the pieces or counters of a game still in use amongst seafaring people. The hole allowed the counters to be placed on the wooden pegs fixed on the playing-board.

'*Sink-stones*' *or Weights.*—The things which commonly go by this name are about 4½ inches high, of a conical form, and are about 4 or 4½ in diameter at the base; they were made without any care and of common clay. The fact that they are perforated towards the point of the cone, and that they were found at a fishing-station, seems to argue for the correctness of the common designation, but subsequent investigations have proved that many at least of these clay cones were simply weights used in weaving, and the reader is referred to the chapter on flax and its manufacture for further particulars. Plate XXXVIII. figs. 16, 18, 19, and 20, may come under the class of weights. The object drawn in two views, Figs. 18 and 19, and possibly also Fig. 20, seem to be of Roman origin.

Plate XXXVII. figs. 9, 15, and 16 are perfect and imperfect specimens of the well-known and problematical moon-images, made of clay mixed with quartz-grains. About two dozen of them are in the collection of Colonel Schwab. The reader is referred for more particulars to the special chapter on these curious objects. Fig. 4 is an ornament (?) of earthenware.

Figs. 6 and 7 are cylinders of earthenware; the middle part is rather smaller than the two ends. The use of them is not known with certainty, but they may have served as supports for the pipkins in the hearth-fires, and have had the same use as the clay rings above referred to.

Plate XXI. fig. 15 is a drawing of what is probably one of the most curious objects found in this settlement: it is a rude figure of a lizard in earthenware, and is remarkable as being the only attempt known to represent animal life.

Several lumps of clay were found here from 1 to 3 inches thick, smooth on one side, and on the other having the impression of wattle-work; they are pieces of what once formed the covering of the hut walls, burnt hard when the settlement was destroyed by fire.

OBJECTS OF BONE, HORN, WOOD, ETC.

Fig. 8, Plate XXXVII. Three arrow-heads of bone. Fig. 11 is a specimen made out of stag's horn, perforated with square and round holes; the use of it is unknown. Fig. 12 is made out of a bear's tooth, and the use of it also is not known. Fig. 13 is a whistle made out of one of the small branches of a stag's horn. Fig. 14 is a string of beads of glass and jet. The glass beads are exactly like those found in such extraordinary numbers in the tumuli of later date and in Roman stations; they consist of the same sort of material as was employed for the better sort of tesseræ or mosaic cubes and for the counters used in games. Respecting the use of jet as an ornament, see the 'Rheinländische Jahrbücher,' Heft XIV. Fig. 31 is a yoke of yew-wood, used by the earliest population of the country for carrying all sorts of burdens. Two clubs of oak-wood were found here, one 20 inches long and the other 3 feet: they are like that from Meilen drawn Plate III. fig. 14. A boat lies embedded in the mud on the Steinberg, made of one thick long trunk of an oak, merely hollowed out either by fire or by hatchets the whole length of the bole. Boats of this description are still to be seen on the lakes of eastern Switzerland, as, for instance, those of Lucerne and Sempach. They go by the name of 'Einbäume.'

CORTAILLOD.

This settlement is of considerable extent; it probably covers three acres. When the lake is low, the depth of water is about seven feet; in ordinary times from nine to twelve feet. The locality goes by the name of Pervou. It is very rich in bronze objects, of which Colonel Schwab, Mr. Otts of Neuchâtel, and M. Troyon possess a considerable quantity, such as armlets and earrings, swords, lance-points, sickles, knives, and hatchets or celts; also several objects of iron, such as knives, shears, daggers, and arrow-heads. Besides these, there are stone celts, corn-crushers, what are called slingstones, and mealing-stones. Earthenware vessels, rings, and spindle-whorls are found here. On the whole, this settlement appears to have been of later date, like that of Estavayer, and probably to have been inhabited about the same period.

Amongst the specimens which were procured in 1862 from this place by Colonel Schwab, the following are probably of the greatest interest:—

An earthenware dish or plate, about sixteen inches in diameter, ornamented with strips of tin. It is drawn about half the full size, Plate XLIII. fig. 5. The lid of an earthenware vessel with strips of tin pressed on its surface was found at Estavayer (Plate XLIX. fig. 1), and one or two other specimens, ornamented in a similar way, have been met with, amongst which is that lately found here, and drawn in the supplementary Plate; but perhaps no example of this peculiar and remarkable manufacture has occurred in such beautiful and perfect condition as the specimen under consideration. The ornamentation consists of plates of tin as thin as paper, which form a striking contrast with the black ground of the vessel. These thin plates are also ornamented with impressed lines, which after the plates were fixed were engraved or indented with a blunt style. By means of this additional work, the tin, which apparently was simply pressed into the earthenware while yet soft, was made to adhere more closely to the clay. The ornamentation consists of a

rosette in the middle formed of quadrangles which is surrounded by a band of a pattern similar to that called the meander, which is so commonly found on the earthenware vessels of the bronze period from the lakes of Neuchâtel and Bienne and also from Ebersberg.* A pattern somewhat similar is also found on one vessel from Wangen on the lake of Constance. This dish was made by the hand alone; the material is a dark-grey clay, blackened by graphite: the lower figure shows a section of this singular vessel.

Figs. 1 and 2 of the supplementary Plate XCV. represent the very remarkable vessel above referred to, ornamented in a somewhat similar manner. Like most of the antiquities described from this locality, it is in the collection of Colonel Schwab. The ornaments on the upper part of it consist of thin strips and plates of tin pressed into the clay. They are executed in a kind of 'graffito' manner: the parts left white represent the tin ornaments; the black is the original colour of the earthenware.†

Amongst the bronze objects many are of the highest interest, and none more so than the wheel drawn Plate XLIV. figs. 4 and 5; it probably belonged to a war chariot (essedum), and as far as mechanical skill is concerned is a specimen of very excellent 'hollow casting.' The middle portion of this wheel consists of a hollow ball, from which radiate the four spokes also hollow. The spokes diminish rather conically towards the felly, and both on the outside and inside have a kind of ridge running along their whole length. Where they join both to the nave and also to the felly, they are strengthened by supports or bases, in the shape of triple rings. The circumference of the wheel is made as it were of a hoop bent up at the sides, the spokes being fastened to the back, and the space between the two cheeks or sides was filled up with a wooden circle of fellies which were fastened on each side by nails. These wooden fellies may probably have projected far beyond the metal casing,

* The pattern on this dish, as shown in Plate XLIII., which is a 'transfer' lately received from Zürich, differs slightly from that originally published. Of course the later drawing is the more correct.—[Tr.]

† 'Graffito' is a mode of mural painting well known in Italy, and possibly also used in England. The wall is first painted with a coat of black, and afterwards with one of white; a drawing is then made on the white coat, and portions are scraped away so as to show the black beneath. In the earthenware vessel above described, the ornamentation did not consist of tin strips and plates of equal size, but one large thin plate, or what would now be called a sheet of tinfoil, was laid on the black ground, and then the parts required to be black were scraped off by a point or a knife.

just as we see similar instances represented in Assyrian sculptures. An axle-box of 3½ inches in diameter projected from one side of the nave; about 2½ inches of it were visible. It is ornamented with a hoop or ring quite at the end, and with another not far from the nave, between which there was the same ring-like arrangement as at the ends of the spokes and also as an ornament on the central boss. The whole wheel had been cast in one piece, but unfortunately when the settlement was burnt, it was partially melted by the heat.

If we call to mind the numerous works of Etruscan art which are found in Switzerland, as, for instance, the vase of Grächwyl, the speculum of Avenches, the numerous bronze statuettes, and many of the specimens described in the present volume, we may probably consider this wheel as the product of an Etruscan workshop.

Plate XLIV. fig. 1 is the neck of a bronze casting broken off when the operation of the founder was completed.

Plate XLIV. figs. 2 and 3; Plate XLVI. figs. 4 and 10; and Plate XLVII. fig. 25, are bronze armillæ: the arrangement of the lines on the three last which form the ornamentation are especially worthy of notice. Fig. 9 in Plate XLVI. shows the section of the armilla (Fig. 3, Plate XLIV.). The specimen of which two views are given (Plate XLVI. figs. 6 and 7) is a portion either of an armilla or of a ring made of very thin bronze; three perforations form a part of the ornamentation.

Plate XLIV. figs. 6, 7, and 8, and Plate XLVI. fig. 8, are what are called moon-figures of bronze; these specimens will be especially referred to in the chapter on moon-images.

Plate XLIV. fig. 9 is a bronze arrow-head.

Plate XLVI. figs. 1, 2 and 3, are bronze implements for suspension.

Plate XLVI. fig. 5 is a massive bronze ring ornamented with engraved concentric circles; it has four holes in it, which originally were filled with stones of various colours.

Fig. 13 is a bronze hook,

Fig. 15 is an earring of bronze with a drop of earthenware.

Plate XLVII. figs. 13 and 21 are bronze pins. Of the large number of pins found in the lake dwellings some were solid, others were hollow in the head, and in some cases there were perforations in the heads at regular distances which apparently had been filled with tin or stones of various colours. The head of the pin drawn Fig. 21 is peculiar, not merely from its size,

but from the mode of its manufacture; it is not cast, but consists of two hollow hemispheres of very thin bronze plate ornamented with rows of round projections or bosses made with the punch and then soldered together.

Fig. 28. An object in bronze the use of which is not known: it is hollow inside, and has the form of an hour-glass or double funnel.

Some objects of gold were found here, amongst which were six earrings of a similar pattern, one of which is drawn Plate XLVI. figs. 11 and 12. A thin plate of a pointed oval form terminates in a wire; the plate is ornamented with a series of raised lines, one within another.

Some bone implements were met with, amongst which may be mentioned the piece of bone (Plate XLVI. fig. 16) which has on one side a series of notches apparently worn by thread. An implement probably somewhat similar, notched but polished by use, and which may have been used for netting or knitting, was found at Robenhausen, and is drawn Plate X. fig. 19.

Plate XLV. fig. 5 is a bone arrow-head.

Fig. 3 is a spindle-shaped implement of stag's horn.

Plate XLVI. fig. 14. A string of beads of bluish and white glass and of amber, similar to those found in tumuli.

Plate XLV. fig. 1 is a small object made of earthenware, perforated with five holes. Fig. 7 is a small earthenware cup or bowl with a handle on one side.

Plate XXII. fig. 16 is a spoon of rather dark-coloured clay.

Fig. 19 is a piece of an earthenware vessel with three holes on each side of the handle, filled with little plugs of wood.

Figs. 31 and 32. Earthenware vessels, the bottom perforated like a sieve. Fig. 34. Part of the rim of an earthenware vessel with knobs, one on each side of the handle, for the convenience of placing the thumb, like some of those from the Terramara, drawn Plate LXI.

Figs. 26 and 30 are bronze ornaments. Fig. 33 is a bronze sickle with a little knob (Fig. 35) near the bottom of the blade, to assist in fastening the handle.

Plate XLV. figs. 2, 4, 6, 8, and 9, are drawings of perfect and imperfect moon-ornaments of earthenware of different patterns. Respecting these singular objects, the reader is referred to the chapter specially devoted to them towards the close of the volume.

The cup, or what is called the strap, of a sling made of platted flax-cords, was found here, and is drawn on the lower part of

Plate LXXXVI. This unique specimen will be described in the chapter devoted to the manufactures of flax and bast.

Fragments of the clay covering of the wattle-work which covered the walls of the huts have been found at Cortaillod. No piece, however, has yet been found in the lake of Neuchâtel of a greater diameter than a foot. Sometimes they are flat, sometimes more or less curved, as they fell into the water when red hot.

Corn, charred apples, acorns, nuts, fennel-seed, and peas have occurred here in several places.

AUVERNIER.

From the report of Professor Desor there were here two settlements, one of the stone and the other of the bronze age. With respect to the first, he says: 'I have discovered and investigated a regular "Steinberg" at Auvernier; it lies at the bottom of the bay, in fact in the most sheltered spot; it is about 340 feet distant from the southern bank and 195 feet from the western shore. The area is nearly two acres, or about 76,000 square feet, and the whole of it is somewhat raised and covered with loose stones, varying in size from 2 or 3 inches to 1½ or 2 feet. The smaller ones are more or less rounded, and have been brought from the shore; many of the larger ones are still as angular as if they had been taken but yesterday from the quarry. There can be no doubt that these stones have been brought from Serrières or Neuchâtel, where the limestone rocks are washed by the lake. The piles stand on this flooring or layer of stones; none of them are less than 7 inches in diameter, and some measure 9½ inches or a foot across. The heads of many of them exhibit either projections or hollows, which may arise from the piles which were too high having been partially sawn through with stone saws at the required height and then broken off.

'Immediately behind this Steinberg the bronze station is found, the piles of which, however, are full 100 feet distant from it. They are very numerous, are driven into a bottom of muddy sand totally different from that of the "Steinberg," and are only 5 or 6 inches in diameter. They project from the bottom 1½ or 2 feet, and are arranged in such a manner as to form a zigzag line, and stretch towards the land in four, five, or even six parallel rows. The depth of water on the Steinberg of Auvernier is 6 feet, or somewhat less than on that of Hauterive, while the bronze station is 14 or 15 feet under the average level of the water.

'An oak canoe, nearly thirty feet long, is lying at the bottom in the bay of Auvernier which,' says Professor Desor, 'I mean to secure. The wattle-work which formed the covering or walls of the huts is lying on the bottom, and consists of poles from

2 to 2½ inches thick, at a distance of 2 feet apart. Rods 1 or 1½ inch thick are closely interwoven crosswise with these poles. Unfortunately this wattle-work is too rotten to be taken up from the bottom.

'From what has just been said as to the strength of the piles at these two stations, the conclusion that the piles of the bronze period were stronger than those of the stone period does not seem to be verified in this locality.'

Several antiquities found here are drawn on Plate XLVII.

Fig. 1 is a richly ornamented lance-head of bronze.

Fig. 2 is an arm-ring of cast bronze, ornamented alternately with zigzag or hatched lines and with lines encircling the body of the ring.

Fig. 23. Flint arrow-head, not barbed. Three different shapes of flint arrow-heads are found in the lake dwellings, thus:

. That now drawn belongs to the first. The second kind, the most artistic of all, may be seen Plate XIII. fig. 13, and the mode in which it was attached to the shaft (Plate XXXIX. fig. 15). These are two views of a flint arrow-head with a portion of the shaft still remaining, the flint being fastened in a notch in the wood, the two sides of which were then secured and drawn tight by a cord. This specimen was not met with in a lake dwelling, and is merely introduced here to show the mode of attachment. It was found on the moor called Geissboden, on the ridge of the Zug mountain. The third sort is always made very sharp on the lowest or narrowest side of the triangle, to allow of its being fixed more easily into the cloven end of the shaft. The colour of these arrow-heads varies from clear yellow to black and dark red. Mineralogists say that these different varieties of flint come from the Swiss and the French Jura mountains.

Plate XLVII. fig. 26. An earthenware drinking-cup drawn in section; a hole runs through the narrow or middle part.

Fig. 27. A great bronze fish-hook.

Fig. 29. Horn-shaped vessel of coarse-grained black clay, with the point bent up. Auvernier is rather celebrated for the variety of earthenware vessels found here, and this appears to be one of the most singular. Its sides are very thin, and are ornamented towards the rim with engraved lines running round the vessel; in these lines are five small holes, one above the other, going quite through. Similar vessels have been

already described from Nidau, and have been found also in other stations. The Nidau specimen is drawn Plate XXXVIII. fig. 6. In describing it we ventured on the supposition that vessels of this kind were used for preparing cheese, the whey oozing out through these small holes. A fragment showing this peculiarity was found at Ebersberg on the mainland. (See Plate XC. fig. 5.)

Figs. 30 and 34. Very neat vessels made by the hand alone; the material is purified and blackened clay: they have a conical base, so that they were intended to stand in rings.

Fig. 31. A little two-handled pipkin with four feet, made by the hand alone out of red purified clay and well burnt. The handles, the rim, and the feet are bordered with three furrows, and round the outer one runs a row of triangular impressions.

Fig. 32. Vessel made of very impure clay mixed with large grains of stone; the lower half is thickly covered with small projections more or less regularly placed, which may have been useful for taking hold of the vessel and keeping it firm in the hand. This arrangement is unusual.

Fig. 33. Earthenware vessel made by the hand alone; it has a large bulge, and is ornamented with the double Greek pattern (or meander line), which unfortunately is not well shown in the sketch. It resembles that on the fragment found at the settlement of Ebersberg, drawn Plate XC. fig. 1. A little above the base the side is perforated with three holes, the use of which is not known.

Fig. 35. A slab of granite with a cup-like hollow about 13½ inches long, and 11⅓ inches wide; the depth of this hollow is 1¾ inch. The stone weighs 88lbs. Several similar stones have been found by Colonel Schwab in the lake of Bienne. They were used as mortars.

Fig. 36. Small bronze chisel in the collection of Professor Desor of Neuchâtel.

THE LAKE DWELLINGS IN THE NEIGHBOURHOOD OF ESTAVAYER AND LA CRASAZ.

The following account of researches made in this district by MM. Béat de Vevey and Henri Rey has been drawn up by M. A. Morlot.

Since the first discovery, in January 1854, of lake dwellings at Meilen in the lake of Zürich, researches on this subject have been carried on in Switzerland to a great extent. The lake of Bienne was examined and worked by M. Müller of Nidau, and by Colonel Schwab of Bienne, especially the latter gentleman, who afterwards came into possession of M. Müller's collection. The lake of Neuchâtel was explored towards its southern extremity, in the spring of 1854, by M. Louis Rochat, and his report is published in the present volume. And about the same time (May 22, 1854) the pile buildings of Morges were discovered, and the greater part of the lake of Geneva was explored by the editor.

Colonel Schwab, having called attention to the piles which are found in front of Estavayer, on the eastern bank of the lake of Neuchâtel, MM. de Vevey and Rey, who live at Estavayer, set to work to explore first this locality and afterwards the neighbouring district. They used merely a pair of pincers fixed at the end of a long pole (see page 9), and as yet have only collected what specimens were visible on the surface of the lake bottom. These gentlemen have in this manner succeeded in obtaining a very interesting collection of specimens, the greater part of which were obtained amongst the piles of the bronze age in front of Estavayer. This locality will bear a comparison as to its bronze treasures with the Steinberg between Nidau and Bienne, and with the lake dwelling of Morges which has been examined by M. Forel. Colonel Schwab obtained at the Steinberg 500 bronze hairpins; but they were not all found on the surface, for he has trenched or excavated the bottom of the lake at this locality. At the lake dwelling of Morges forty bronze celts, thirteen bronze knives, and many other specimens were found, all on the surface; and

Estavayer up to the present time has produced the remarkable number of 128 bronze hairpins, and many other specimens of the settlers' industry, all lying on the surface of the lake bottom. At the present time we have to do chiefly with the objects found at Estavayer.

There are two pile works at Estavayer, remains of ancient lake dwellings; one near the shore, where nothing has been found but some stone and bone objects, without anything of bronze, and which therefore seems to date from the stone age; the other farther from the shore, which has yielded a quantity of bronze implements, and which we may therefore without hesitation attribute to the bronze age. It would seem as if the introduction of bronze having augmented the powers of action, the settlers had removed farther from the shore and established themselves in deeper water. This confirms my opinion that the chief end of these lake dwellings was the defence against enemies.

LAKE DWELLING OF THE STONE AGE AT ESTAVAYER.

It measures probably 120 paces long by 60 paces broad, and runs parallel with the land. The space between the piles and the shore, which may be 45 paces long by 15 wide, was dry in the winter of 1857, but in general the bottom, which is pebbly, is covered with from two to four feet of water. A small stream, which runs through the town of Estavayer, here falls into the lake, and it may be that the alluvium brought down by it may have added to the shore and thus brought the mainland nearer to the lake dwelling; but as the specimens of ancient industry have been found on the surface of the lake bottom, this hypothesis is hardly admissible.

The following objects were found here:—

A dozen flat stones rounded, from $1\frac{1}{2}$ to $2\frac{1}{2}$ inches in diameter, perforated with a central hole; they may have been used as weights for the spindles used in manufacturing thread.

Two halves of two hammers of serpentine; one has a well-made hole for the reception of a handle.

Two arrow-heads of brown flint, apparently of a kind not found in Switzerland (Plate XLVIII. fig. 25). These specimens are pretty well worked; they are $1\frac{1}{2}$ inch long.

A well-preserved hammer of stag's horn (Plate XLVIII. fig. 27). At one end it is rather rounded, as if to strike with, but at the other end it is a little hollowed out, as if it had formed a

hafting for a stone celt or wedge; but on carefully examining this hollow it seems more probable that it results simply from the natural decay of the interior spongy part, and that a stone wedge was never intended to have been fixed in it. The hole for the handle is oval and well made; it is $1\frac{1}{5}$ inch long and $\frac{5}{4}$ inch broad. The length of the whole specimen is 5 inches.

A stone hammer-hatchet (Fig. 29), remarkable for the beauty of its workmanship, and bearing a strong resemblance to the excellent stone hatchets or celts found in Denmark, which are attributed to the bronze age. Implements of this form have not in general been considered as cutting instruments, for the edge in most cases is rounded, but rather as marks of distinction—as hatchets indicating command, and corresponding more or less with the baton of a marshal. The specimen, however, found at Estavayer has the edge sharpened; and a second characteristic, distinguishing it from the northern specimens, is that the hole for the handle is not round, but of an oval form, rather regularly made, about $1\frac{1}{7}$ inch long and $\frac{3}{4}$ inch broad. The whole length of the specimen is $5\frac{3}{4}$ inches. On the upper part is a median ridge, projecting about a line or a line and a half, which has been formed by careful and regular work on a fixed grinding-stone or slab. The whole specimen is well worked and perfectly symmetrical, but one side of the end used for a hammer appears to have been notched and then again applied to the grinding-stone on this side, in order to flatten the fractured surface. The material is a dioritic rock, with particles of felspar; it is hard, is not scratched by the knife, and appears to have come from some locality not in Switzerland.

Four celts or regular hatchets, not perforated, made of common serpentine, probably from the erratic blocks found in the neighbourhood of Estavayer.

Rather a large tongue of flint, of a kind not found in Switzerland; it appears to have been shaped so as to form the point of a lance.

A flake also of foreign flint, which has been used as a saw.

LAKE DWELLING OF THE BRONZE AGE AT ESTAVAYER.

It is situated about 400 feet from the shore, and occupies an area of nearly 7,700 square feet. The water here is six or seven feet deep. There are a considerable number of piles, and this is the locality which has been most carefully examined by MM. Rey and de Vevey. Dr. Keller had previously announced

that lake dwellings and antiquities had been found here; as, for instance, celts made of serpentine, flat grinding-stones, corn-crushers, pottery rings or 'torches,' and spindle-whorls, both made of baked clay; also knives, sickles, bracelets, and hair-pins, all of bronze. The following is a list of the bronze objects collected here by MM. Rey and de Vevey:—

Hairpins with great ornamental and spherical heads	36
Common hairpins	92
Knives	26
Bracelets	15
Sickles	5
Celt or hatchet	1
Fish-hook	1
Chisel	1
Rings of different kinds. Earrings (?)	27
Buttons	2
Blade of dagger	1
Arrow-head	1
Flattened wire coiled in a spiral form	6

It will be seen that this is a rich locality. It is especially remarkable for the number and beauty of its hairpins and knives, while celts are almost entirely wanting. We will now consider some of these specimens a little in detail.

The hairpins with spherical heads are of various sizes and lengths. The pin with the largest head, about $1\frac{1}{4}$ inch in diameter, is drawn Plate XLVIII. fig. 4. The head is hollow and has been cast, which is generally the case with all the bronze objects of this period. The shank goes through the head, and has been rivetted or beaten to a small knob above; but some play has been allowed below, so that the shank can slide a little way and appear above the head, and the pin has been drawn in this position. This specimen weighs $2\frac{1}{2}$ ounces troy, of which the head alone weighs 2 ounces. The pin is nearly 9 inches long.

The other hairpins with spherical heads, though often longer, have smaller heads, which are hardly one inch in diameter; they are ornamented in the same manner, but more simply. Three bands, each consisting of three or four even lines, bordered on each side by a dotted line, as in Fig. 4, go straight down from the concentric circles round one pole to those of the opposite pole. The three fields on the surface of the sphere thus separated by these bands have each in the centre, as it were under the equator, a round hole $2\frac{1}{4}$ to $2\frac{3}{4}$ lines in diameter, surrounded by three concentric circles, bordered by an exterior dotted circle

as in Fig. 4, only the poles thus set in a framework, as it were, of circles, are isolated, while in Fig. 4 they are joined alternately with the upper and lower poles by bands of lines, which in this specimen do not go from one pole to the other. In Fig. 4 the sphere is divided into quarters; four bands, each consisting of two or three lines, go from each pole till they meet the poles in the opposite hemisphere, as may be seen in the drawing. In the pins under consideration, of the ordinary size, like those drawn Plate XXXIV. fig. 5, from Nidau, the heads are also hollow, and the sides or walls of the sphere may probably be $1\frac{1}{2}$ line thick. Hairpins of this kind are found elsewhere, but nowhere so abundantly as at Estavayer.

Besides the pins with spherical hollow heads, a great number of others have been found, as already mentioned. Some of the most interesting have been drawn Plate XLVIII. figs. 3, 5, 6, 7, and from 9 to 14.

Fig. 6 is rather curious. The pin is ornamented with chevrons for half its length; the head is massive, and the whole weight of the specimen is 2 ounces troy, though it is only $5\frac{1}{2}$ inches long from the head to the point, which is quite perfect. To keep a pin of this description in the hair, it must have been used for tresses or very close plaits. This great variety of hairpins seems to indicate that in general the hair was richly developed. Bearing on this point, it may be well to remember that two hair (?) pins of bronze were found near Berne, cast from the same mould, weighing actually nearly 11 ounces, and of the astonishing length of nearly 34 inches.

The shank of the pin drawn Fig. 9 is perforated; the hole has been represented in profile in the figure. No remark need be made as to the others drawn.

The pins found at Estavayer vary considerably in length; that of the five longest is from 10 inches to $10\frac{3}{4}$ inches; that of the five next in size is from $7\frac{3}{4}$ inches to 9 inches. The three shortest pins are only $2\frac{3}{4}$ to 3 inches long; a considerable number are about $3\frac{1}{2}$ inches in length.

As before mentioned, Estavayer is remarkable for the number and beauty of its bronze knives, drawn Plate XLIX. figs. 2, 3, and 7 to 15. They indicate, in fact, such an amount of luxury in this class of implements as can be found nowhere else in Switzerland, thus almost certainly showing that they were industrial products which belonged rather to the end than to the beginning of the bronze age; for knives with a longitudinal cutting edge, like those of which we are speaking, appear only

gradually to have replaced the hatchet-knives or celts with a transverse edge which were, in fact, simply the reproduction in bronze of the instruments so commonly in use in the stone age.

Many of these knives are ornamented on both sides, and also on the back, as is shown by the drawings. Others are not ornamented, but still have a very elegant form like that drawn Fig. 2; lastly, others, like Fig. 3, are very coarsely manufactured.

The backs of many of these knives have been thickened at the sides, to give more strength to the instrument, but still the metal was husbanded and the edge was left thinner, like that of our modern razors. It will be seen that transverse sections are given of Figs. 10 and 14. The ornaments of these knives are in good taste and in the style characteristic of the bronze age, with the exception perhaps of the specimen drawn Fig. 14, which has something strange about it. Fig. 15 shows the ornaments on the back of this knife.

Many of these knives have been very decidedly and regularly in use, such as Figs. 10 and 2. They have evidently been used to cut soft materials, like flesh, skins, or tissues. Fig. 7 has been used especially towards the end which is sharp up to the angle formed by the back. The two largest specimens (Figs. 8 and 9) are both 9 inches in length.

Fig. 4 appears to be the blade of a dagger, but it has been inserted into the handle rather differently from the mode usually seen in bronze specimens. Plate XLVIII. fig. 1 is a little bronze chisel. Fig. 26 is an arrow-head of bronze with a crack or flaw on the side, as may be seen in the drawing;* a little round hole runs from one side of the socket to the other, to enable it to be rivetted to the wood of the arrow. Fig. 28 is a bronze hatchet of the kind improperly called a celt. The socket being round would have allowed the hatchet to have turned round on the handle, but to prevent this the moulder has arranged four longitudinal ribs running all along the inside of the socket, and about half a line high. The socket is $2\frac{3}{4}$ inches deep; the whole length of the specimen is $4\frac{1}{2}$ inches. The cutting edge, which is a little curved, is $1\frac{1}{2}$ inch

* As this flaw is in the shape of a pretty regular crescent, many persons have thought that, instead of a flaw, it was an intentional groove or gash for the insertion of poison. The strongest vegetable poison of Switzerland would be got from the euphorbiacean plants, and this would not be powerful enough to cause death. But it is not impossible that the settlers may have obtained more active poisons from their commerce with the East.

long. As already mentioned, it is the only hatchet which has been found at this locality, while forty have been dredged up at Morges; but they are quite of another sort, like those called 'Paalstab' in the north, and which have been fastened to a cleft handle by means of four side flanges.

Plate XLVIII. fig. 31. A bronze sickle of the usual form, but very large. The diameter of the semicircle formed by the outside is $6\frac{3}{4}$ inches. The transverse section of the blade is represented at *a*, below the figure.

Figs. 19 and 20. Different views of a little implement of bronze, which, though thin, has still been cast: it is in shape nearly like a button, and has doubtless been used as an ornament for some tissue or skin.

Fig. 24. A fish-hook of bronze, like those found by Colonel Schwab at the Steinberg of Nidau.

Figs. 16, 17, 21, and 23, are bracelets. Fig. 21 is massive, and has the opening oval; its greatest internal diameter is 2 inches. Fig. 16 is thin; it is only about half a line in thickness. Fig. 17 is more massive, the greatest thickness of its transverse semicircular section being one-fifth of an inch. This specimen is too large to have been worn on the fore-arm, for the opening, which is of an oval form, is $3\frac{1}{2}$ inches across where the diameter is the largest. Fig. 23, of which the section is given below, is rather oval, and the diameter where greatest is little more than $1\frac{1}{2}$ inch. If it was intended for a bracelet, it must have been that of a child. The ornaments on all these bracelets are of the style usual on specimens of this nature in the bronze age.

Fig. 18. A bronze ring which is rather thin: the opening is oval; the greatest diameter measures $\frac{3}{4}$ inch.

Figs. 2 and 22. Bronze spirals. Fig. 2 is of bronze wire; the section is semicircular, and is shown on one side. Fig. 22 is of very thin bronze plate, not thicker than a quarter of a line.*

Plate XLIX. fig. 1. A specimen of rather fine pottery, with

* My friend, the Rev. C. W. King, in a paper yet unpublished, but which is elsewhere referred to, speaking of the armour of the Gauls, quotes Diodorus, who says that 'their shields are as tall as the men, and painted over in a peculiar fashion: some of them have figures of animals in relief of bronze, not merely for ornament but also for defence, and very well wrought.' On this passage Mr. King remarks: 'The flat spirals of considerable diameter in stout bronze wire so often found on the Continent, were doubtless some of the ornaments fixed upon these shields. Their construction would afford great additional strength with very slight increase of weight to the substructure of boards and hide.'—[Tr.]

the surface blackened and polished, and having the appearance of the cover of some vessel. On examining the surface of the inside, which is in very good preservation, it will be seen that though regularly circular, this vessel has not been made with the wheel. The edge appears to have been ornamented all round with leaf-tin, some portions of which still remain. From this edge or border four thin bands of ornamented tin run on the outside from four different points, carried nearly to the centre of the specimen. One of these bands is still in good preservation; it is simply laid or pressed upon the vessel, and is not rivetted: the remaining bands have only left their traces. The handle is in the shape of a semicircle at the top of the vessel, it also is ornamented with tinfoil. The metal has been examined by Professor de Fellenberg, and proves to be pure tin without any mixture of lead. The diameter of the specimen is $5\frac{1}{2}$ inches; the height, including that of the handle, is 2 inches; the thickness of the sides or walls is about one line.

Plate XLVIII. fig. 15 shows the section of this cover.

Another specimen, no less interesting, is a little bar of tin made into a prismatic form by the hammer. It is $7\frac{1}{3}$ inches long; its greatest thickness is $\frac{1}{3}$ inch, and it weighs half an ounce. The colour of the metal and its great ductility show that it consists of pure tin, thus confirming the assay made by M. de Fellenberg, who did not find in it a trace either of lead, zinc, copper, or iron.

We cannot venture to conclude, from the presence of this little bar of tin, that the metal was employed on the spot to make bronze. The cover ornamented with tin, and which has been already described, proves that this metal was employed in a pure state to ornament different objects, as is still the case in some countries.

Lastly, Fig. 30, Plate XLVIII. represents a wedge or celt of serpentine found amongst the piles of the bronze age. It is a knife-hatchet with the cutting edge curved, and a little oblique. It fits the hand very well, and evidently was not intended to have been fixed in a handle. It was probably made from the serpentine of some erratic block found in the neighbourhood, but it may possibly also be of some stone not found in Switzerland. It is schistose and very hard; it cannot be scratched with the knife.

Full half a league north-west of Estavayer, near the village of Autavaux and La Corbière, there is a place called La Crasaz,

where there are two lake dwellings in the lake, as at Estavayer; the one nearer the shore, of the stone age; and the other farther in the lake, of the bronze age. These localities, as at Estavayer, are situated near where a stream runs into the lake, and this, in fact, is in general one of the conditions which seem to have determined the choice of the situation of lake dwellings. These piles at La Crasaz are known to the fishermen, and, as well as those of Estavayer, are called by them Les Tenevières.

LAKE DWELLINGS OF THE STONE AGE AT LA CRASAZ.

When the water is low, the lake here is only from one to five feet deep, and the piles are then very near the shore. The following are the specimens which have been found here.

Three tongues or flakes of a clear brown flint, a kind not found in Switzerland. The largest (Plate XLIX. fig. 6) is 7½ inches long, being, in fact, the largest which has been found in Switzerland. Similar ones, but smaller, have been found at Concise. The specimen, as will be seen by the figure, is worked very regularly on one side, while the other is formed simply by a tolerably even fractured surface slightly convex in the direction of the length, and produced by the blow which detached it from the original block of flint. The section is nearly semicircular. This flake can hardly have been used as a lance-point, for then it would have been worked on both sides, and more especially some attempt would have been made to do away with the concavity of the posterior face towards the two ends. It is also too thick to have answered for a saw. It may possibly have been used for hollowing wood or scraping skins: some use of this nature appears at least to be indicated by the fact that the lower face has been left perfectly level and intact.

A celt of serpentine hafted in a piece of stag's horn, made with a mortise so as to have had in its turn a wooden handle like those which have been found elsewhere in Switzerland, and especially at Concise. A wedge or celt of serpentine not hafted. The half of a celt or hatchet made of serpentine very neatly pierced with a hole for the handle. Plate XLIX. fig. 5 is a hatchet of stag's horn. This specimen is in good preservation and is very interesting. At the larger end a hole has been made through it for a handle; this hole is rectangular, with the angles rounded, and is 1⅛ inch long and 1 inch wide. At the other

end the horn, as shown in the figure, has been left on one side in its natural state, while on the other it has been cut off obliquely, so as to produce rather an irregular cutting edge, but placed so that it evidently formed part of the plan of the instrument which has been actually used, as may be seen by the polish of the horn in this part. It is clear that this instrument has never had the addition of a stone celt or any other cutting material. It may be well to mention this, for at Concise, where similar specimens have been found, the workmen, to make them more interesting, have fitted stone celts into them, and thus disfigured them. It is very probable that this specimen has been used as an agricultural hoe. The length is 9 inches.

Two pointed tools or awls of bone. Several small disks, probably spindle-whorls. A fragment of pottery, tolerably fine and ornamented.

Lastly, there has been found here a bronze hairpin (Plate XLVIII. fig. 8) with a little bronze ring passing through the head; but as the bridge or stage connecting the shore with the lake dwelling farther off in the lake would doubtless pass over that now under consideration, this pin may probably belong to the age of the more distant settlement.

LAKE DWELLING OF THE BRONZE AGE AT LA CRASAZ.

It has as yet been little worked, and yet a few things have been found there, such as two good bronze hairpins, two little bronze rings, and an earthenware vessel very neatly finished, as if it had been made by the wheel.

MM. Rey and De Vevey have taken the trouble of drawing up some of the piles from this spot to examine them; they are of oak, and the part covered with mud was in a very good state of preservation; that part which projected above the lake bottom is very much worn away, as is the case in other localities. These piles are about $9\frac{3}{4}$ inches in diameter. The part buried in the mud, or that which had been driven into the lake bottom, was about 4 feet 11 inches or more in length. The whole of this portion has in general been sloped into a point in a very regular manner; the blows of the celt or hatchet followed each other in the same direction, producing facets running nearly all along the point almost exactly in the same planes. The workmen evidently were clever carpenters. The facets are not more than $1\frac{1}{2}$ inch wide, which is exactly the width of the bronze

celt found at Estavayer (Plate XLVIII. fig. 28). The workmanship of the piles of the lake dwelling at Moosseedorf of the stone age is altogether different and much rougher, for every blow of the hatchet is on a different plane, and there is no appearance of any regular facets. The piles of the bronze age at La Crasaz are so regularly worked that one would imagine they had been made, not by the bronze celt or hatchet, but by a strong steel tool used with both hands. The difference of the hatchet-work on the points of the piles of the stone and the bronze age is as great as that between the point of a pencil cut by a child, and one cut by a grown person with a firm hand and accustomed to the work.

At the south-west of Estavayer, near Font, MM. Rey and De Vevey have also found indications of antiquities on the shore of the lake. We will at present only just mention the 'find' of bronze hairpins in the natural grottoes in the escarpments of the 'molasse' of this dictrict. As MM. Rey and De Vevey are continuing their explorations, we may hope before long to have a supplement to the present notice, with more ample information as to the antiquities of the neighbourhood of Font.

It may be well to append to the above report of MM. De Vevey and Rey a notice of some antiquities found at Estavayer, and now in the collection of Colonel Schwab of Bienne.

Plate L, fig. 1 represents a bar of tin nearly six inches long.

Fig. 2. A bronze arrow-head.

Fig. 3. A bronze saw.

Fig. 4. The ferrule of a stick (if this word can be applied to an implement made of bronze).

Fig. 5. A thin armlet of bronze.

Fig. 6. Ornament made of thin bronze plate.

Figs. 7 and 8. Two views of a disk cut from the horn of the elk.

Figs. 9 and 10. Two views of a bronze nail with a kind of socket at the top.

Fig. 11. Bronze boss.

Figs. 12 and 13. Stones of the kind commonly called 'sling-stones.'

Plate XLIII. figs. 1, 2, 3, 4. Fragments of pottery ornamented with narrow strips of tin, like the larger vessel of a similar kind found at Cortaillod.

Some jet rings and a little cramp and plate of gold were found here.

Plate XXXIX. fig. 10. Neck of a vase 3 inches wide, made of black, well purified clay, without grains of stone; the sides are only 1½ line thick. The mouth on both the inside and outside edge is set with a narrow strip of tin as thin as paper. These two strips, which are about 1½ line apart, are bound together in four places by small tin bands. This vessel appears to have been made by the same workman as the cover drawn Plate XLIX. fig. 1, or at any rate to have come out of the same workshop.

Plate XXXIX. fig. 11. Blunt hatchet of serpentine with a haft-hole. Some remarks as to the mode in which these perforations were made in early times will be found at page 78 of Sir W. Wilde's 'Catalogue of Irish Antiquities;' in the earliest ages he thinks they were made by turning round a hard stone, and in after times by a metallic drill.

Plate XXII. fig. 29 is a well-made arrow-head of bronze.

NOTES ON THE LAKE DWELLINGS IN THE NEIGHBOURHOOD OF YVERDON.

By M. Louis Rochat.*

Remains of lake dwellings have been found in the neighbourhood of Yverdon, at Concise, Corcelettes, Les Uttins, Clendy, and Cheseaux; that is to say, that except in front of Grandson, where the water suddenly becomes very deep, and at Yverdon, which is built on recent alluvium, each of our modern villages has a corresponding lake dwelling in front at a short distance (see the small map, Plate LIII. fig. 1). If the marshes of the Orbe were trenched, very probably piles would be found opposite to each group of modern dwellings.

The piles of Clendy and Cheseaux, though at a short distance from the town, have not been investigated.

Les Uttins are situated about twenty minutes' walk from Yverdon, at the eastern foot of Mont Chamblon. Piles like those in the lake are found there in the turf-pits. Springs of excellent water rise from the foot of the hill opposite to each of them. The following section was pointed out to me in one of these turf-pits by M. Ch. Simond, Plate LIII. fig. 2. The upper bed of vegetable mould is about 17 inches thick; about 4 feet 4 inches below were two great trunks of trees lying down with their roots; and about 6 inches below this, and consequently about 6 feet 3 inches from the surface of the soil, the heads of piles begin to appear, worn to a point in the same manner as they appear in the lake; these piles go through first about 18 inches of peat, then about a foot of fine clay, and go still 18 inches deeper in a bed of very hard peat underlying the clay. This lower bed of peat is about 3 feet thick.

Two groups of piles may be seen at Corcelettes. The first, to the east of the hamlet, is at least 690 feet long and 426 broad. The area may be estimated at 25,000 square yards. The lines and groups of piles are remarkably regular. When the water

* This paper gives so much information, and is of so much importance, that it is useless to attempt to abridge it; we have therefore given it entire.—[Tr.]

is low, they are at no great distance from the bank. The second group of piles is to the west of Corcelettes, in front of the property of M. de Bossey. It is a rectangular enclosure, called Port à la Reine, about 32 feet long by nearly 20 feet broad. The sides or walls, about 3 feet thick, are in perfect preservation, and are formed of three rows of piles with the spaces filled in with pebbles; they might easily have been taken for the foundations of a tower. The interior, which is full of mud, has not been trenched.

At the entrance of the little bay, which before the construction of the railway was used as the port of Concise (Plate LIII. fig. 3), a hillock or shallow is visible at the bottom of the lake, about 260 feet from the shore, called by the inhabitants La Tenivière. All round La Tenivière the dredge only brought up great round pebbles mixed with mud, but when it was set to work on the shallow, the boats were filled with broken stones of various sizes mixed with piles and other remains of human industry. These stones, which evidently had been artificially broken and brought here, make La Tenivière analogous to the Steinberg or hillock of stones at Nidau. This Concise Steinberg is nearly in the shape of a semicircle, with the convex parts looking south and turned towards the lake. It is 459 feet long from east to west, and about 255 feet broad from north to south. When the lake is about 6½ or 7 feet below the highest level, the top of La Tenivière is only about 11 inches under water. Around this point the depth augments rather rapidly; at the foot of the southern slope it is 6 feet 10 inches, but on the northern side only 4 feet.

About one-fifth of La Tenivière has been examined by the dredge or scraper. There is hardly any accumulation of sand, so that some remains may be noticed on the surface. The piles may be seen in the trenches, scooped out by the dredge, and penetrate the bottom from 5 to 6 feet, but it is useless to look for any remains of human industry so deep; nothing made by man is found below 10 or 12 inches under the surface of the bed of the lake.

The locality of the piles at Cheseaux and Clendy is, like that at Concise, a raised hillock formed of broken stones. At Corcelettes the stones are not found over the whole surface. In more than ten places, where fragments of pottery were found on the surface, I was able to thrust in a pole nearly five feet, without finding anything but sand. At Les Uttins there is no trace of a Steinberg under the peat.

At Concise, no characteristic fact has enabled me to ascertain with certainty why all these broken stones have been brought here; but perhaps when more carefully examined their arrangement with respect to the other industrial remains may explain their use. They probably are now found exactly in the same position as when they were first thrown down, for the force of the waves goes very little below the surface. Thus at Corcelettes, at a depth of about 5 feet, I dredged up, very near to each other, two fragments of the same vessel, the edges of which, when cleared a little from the mud which covered them, fitted exactly; the angles were sharp and the waves, consequently, had not rolled them about.

Most of the stones of the Concise Steinberg doubtless served as a kind of breakwater, not against the violence of the waves, but to consolidate the ground around the piles. If they had been accumulated on the edges of the platform to serve as a defence, as some people have imagined, they would still form around the piled area a border of stones which I believe has never been noticed. An opinion has also been expressed that they were laid upon the platform to consolidate it; but this apparently would have been very useless.

The beams or planks forming the platform for the huts are not met with in any of the localities cited. The peat-cutters at Les Uttins have often spoken to me about horizontal beams with mortises; they even assert that there was a wooden road there, across the marsh, but nothing of the kind is now visible.

Neither have we found any of those fragments of clay, half-baked (by the conflagration?) which were used to cover the wicker-work or walls of the huts.

The piles we found were of oak. M. Simond tells me that he got from his turf-pit one made of a cherry-tree with its bark on, and another of ash; but I have not seen them. We also found a yew-branch cut with a stone celt, and two pieces of fir-wood, and this is the whole that we learn from our collections as to the trees of this period. But, on the other hand, it contains numerous specimens of instruments which were used for fashioning the wood, and doubtless also for other purposes.

At Concise hundreds of haftings for the stone hatchets and chisels have been found, made of stag's horn. I have drawn (Plate LIII. figs. 4, 5, 6, 7, 8) some forms which are new, but none of the pieces in which these haftings were fixed have been found here.

The stone celts or hatchets have been met with in great numbers, and we possess more than eighty. Some were still firmly fixed in their haftings by means of fibres of bark. When they were sharpened on the whetstones or sandstones they were not taken out of their handles, for when the stone or cutting portion is rather short, the bevilling is continued on the edge of the handle.

The observations made at Meilen as to the shape, the size, and the original material of these instruments, might be repeated at Concise. Most of them are of serpentine from the Valais, some of silicious sandstone (lidyte?), two of transparent jade (nephrite). A large number are merely sharpened pebbles; some few have been made as if by the picks of our masons, and on many of them may be noticed traces of the saw as clearly as those produced by our modern tools. It seems very difficult to imagine how results like these can have been obtained without metals.

There is nothing particularly new in the forms or dimensions. I have figured the knife (Plate LIII. fig. 9) because of the obliquity of its cutting edge; and the chisel (Plate LIII. fig. 10) because it is sharpened at both ends.

One single bronze celt has been dredged up at Corcelettes by Colonel Schwab.

What served for saws were pieces of flint, sometimes seven inches long, serrated either on one or both sides (like that from Meilen drawn Plate III. fig. 3); some which are very thin make excellent sawing tools. Those which terminate in a point have probably been used as awls; some of the others to enlarge the holes when made (like that drawn Plate III. fig. 2). We have also got flakes wider and shorter, with a semicircular serrated edge (Plate LIII. fig. 11), which appear to have been hafted saws, like that found at Moosseedorf by Dr. Uhlmann, drawn Plate V. fig. 5.

The piece of stag's horn, drawn Plate LIII. fig. 13, is like an unfinished handle, but the great end looks battered, so that it has been used as a hammer.

Our best hatchet-hammers of stag's horn are drawn Plate LIII. figs. 12, 14, 15. We have also fragments of others, more carefully worked, and of a better form. None have been found with the hatchet or celt still fixed at one end, in the original form. The specimen drawn Plate LIII. fig. 16 is cut with a sharp bevil at the end, where it seems as if a hatchet should be fixed.

The hatchet-hammers of stone are rarer than those of stag's horn; they are like those previously described by Dr. Keller. The finest fragment of a tool of this kind is drawn Plate LIV. fig. 1; it has two grooves on the side, its form is elegant, and it is beautifully polished.

Plate LIV. fig. 2 is a perfect hammer-hatchet in the collection of M. Clément of St. Aubin.

Plate LIV. fig. 3 is an irregularly shaped pebble, pierced with a great hole; if intended for a hammer, it must have been a very inconvenient one.

The nature of the antiquities found throws back the date of the pileworks of Concise, Corcelettes, and Les Uttins to a very early age, and shows that they existed for a lengthened period. In the two first localities, bronze objects of excellent taste and workmanship, sawn stone celts, hatchet-hammers perforated with the drill, and earthenware vessels thin and well ornamented, are found together with sharpened pebbles and the coarsest kind of pottery made by the hand alone. At Les Uttins a bronze bracelet has been obtained from the same peat-digging in which two stone celts had previously been found.

But besides the nature of the objects, the locality of the pileworks at Les Uttins may give us an idea of their great antiquity. A vast plain formed by alluvium extends between them and the lake; one of them is 1,850 yards, and the other 2,200 from the present bank, and the whole of this plain is composed of matter brought down by a little torrent called La Brine.

This marsh has been carefully surveyed, with a view to its being drained, and the engineers who have examined it admit that a very long time would be required to form a similar deposit; but taking the local circumstances into account, they do not think it can be determined, even approximately, when the lake washed the foot of Mont Chamblon, so as to allow the inhabitants to erect their curious structures in that locality.

The handle of the beautiful bronze sword found at Concise in 1832, as well as those which I have seen in the collections of M. Troyon and Colonel Schwab, show that the inhabitants of our lake dwellings had smaller hands than those of our present race of men; but the human remains in our possession are not sufficient to indicate any other physical character. Amongst an extraordinary number of bones, we have only found one fragment of an adult human skull, the frontal bone of a child, and a lower jaw with the second great molar tooth springing up. There are no traces of the knife on any of the remains, and from

the small number of them we may conclude that the people were not cannibals. The products of their industry seem to me to indicate a slow but constant progress in the art of employing the resources of the country; and this progress places them on the score of intelligence far above the savages of the present day.

We have met with no flax, like that so common at Wangen and Robenhausen: the only similar material was a little parcel of bark filaments, very finely divided, which may have been 'bast.' The little roundles, or circular objects like counters, perforated in the centre, are generally considered as spindle-whorls; two have been found made of stag's horn, two of pottery, two of the stone called 'molasse,' and thirteen of lime-stone. In two of those of the last-named material, the hole has been made with a bad piercing tool, probably of flint; in one it has been made by a point or pick, in all the others by the drill or lathe. I will venture on a remark or two as to the use generally assigned to them. Those made of stag's horn are very light for the purpose, and those of pottery very fragile, while the holes in those made of stone are often very eccentric (Plate LIV. figs. 4, 5); they are of all varieties of size, and sometimes very small indeed. One belonging to M. Clément is only a line in diameter. If a twig or short rod had to be fixed in the hole, how could it be held firmly in the disk (Plate LIV. fig. 6), and in most of those where the hole is wider towards the outside, and of which the section takes the form of a double cone, one on each face? I may remark, lastly, that we have found an oval stone with *two* perforations, which I had put aside amongst the things probably forged; but when I found that Dr. Keller had also discovered a similar one, I replaced it, following the series of those with a single hole.

The weaver, the dyer, the tanner, and the tailor have left us nothing characteristic at Concise; we have found neither the material like matting of Wangen nor the coarse cloth like that of the cloak found in Denmark, and said to belong to the bronze age.

We have found no bronze needles similar to those of the present day, but on the bone point (Plate LIV. fig. 10) certain notches with rounded angles may be observed, like those produced by the friction of a thread. The pig's incisor (Plate LIV. fig. 11), the root of which has been split and sharpened, may probably have been used to perforate cloth or leather. It would be interesting to ascertain the use of the stiletto of bone

pierced at the point by a rectangular hole, drawn Plate LIV. fig. 35.*

If the clothing of the women of that period at all harmonised with the objects used for ornament, it was deficient neither in taste nor variety. Concise has added eight or nine bronze hair-pins to hundreds which I have already. From Corcelettes we have obtained a bronze hollow bracelet, but there is nothing in it particularly remarkable. The collection of M. Troyon contains a bronze hairpin, with a ring for the hair-band to go through; our specimens in stag's horn, drawn Plate LIV. figs. 20, 21, have doubtless formed the model for it.† Fig. 22 is also a model in bone of the ordinary bronze pins. Fig. 23 represents a pin rather short and slender, if used for the hair.

Fig. 24 is the drawing of the fragment of a bone pin; the head is flattened and is pierced with two holes.

It is a curious fact that the bronze ornaments are only improved copies of the analogous objects in bone. I have heard the opinion expressed that the colonists of the age of stone were different from those of the age of bronze, and that iron was suddenly introduced by new and more civilised tribes, whose superiority arose from a knowledge of this metal. The population of the age of bronze are said to have been stronger than that of the age of stone—even the very dogs were larger. These sudden transformations of rural populations have something very singular about them. Nothing similar appears in historic times. The reproduction in bronze of the coarse bone ornaments of previous ages shows that the people of these two periods had the same tastes and the same customs. Our collection does not possess a sufficient number of specimens for comparison; but the museum of Colonel Schwab contains many iron implements, which have been forged with difficulty after

* May this not have answered the purpose of a coarse needle? An instrument almost exactly similar in form but made of iron, and often with a wooden handle, is used by our modern wine merchants, and in fact by all those who have to pack *coarse* hampers. A piece of strong twine is passed through the eye or hole, so that only a few inches hang on one side, and the sharp end of the instrument, which is very strong, is forced by means of the handle through the edges of both the hamper and the cover: of course it carries the string with it, which is then drawn out of the eye and pulled tight; the instrument is then drawn back, and the process is repeated. This may seem a slow operation, but it is very effective in the case of rough coarse hampers; a packing-needle of moderate size can hardly be forced through the plat-work of a strong hamper.—[Tr.

† Probably the specimen drawn Plate XLVII. fig. 22, from Concise, is of a similar kind. It is a kind of curved pin with a perforated projection on the convex side; a string or cord has apparently been passed through the hole.

the model of analogous specimens cast in bronze. The new metals appear to have been gradually substituted for the material previously in use, without any change in the mass of the population, except by a gradual improvement. Things take this course at the present day.

The bears' teeth perforated at the extremity of the root (like that drawn Plate III. fig. 6) have been frequently found at Concise. One drawn Plate LIV. fig. 37 has a circular groove all round instead of a hole. We have also whole boars' tusks with a round hole at the thick end on one side, but it does not go through to the other (Plate LV. fig. 15). There may be a question as to whether these perforated teeth were used as ornaments, but the two little specimens drawn Plate LIII. fig. 20, and Plate LIV. fig. 19, most probably have been the beads of a necklace. One is only a bit of horn roughly rounded and perforated, the other is a little bone cylinder, cut away in the middle and perforated lengthwise at the two extremities; the workmanship is so good that it would be no discredit to a modern necklace. Plate LIII. fig. 19 may also have been a necklace-bead. The rectangular plate drawn Plate LIV. fig. 25, made of the enamel of a boar's tusk, and with a little hole at each end, may probably have been rivetted on to a strap; the oval plate of the same material (Plate LIV. fig. 39) has the holes well polished and splayed on each side; a cord has evidently passed through them.

Fig. 36, Plate LIV. represents the fragment of a jet bracelet, small but well executed.

The bronze wire (Plate LIII. fig. 18), with the two ends curved into a close spiral, is a curious ornament of the same design as several beautiful specimens in the museum of Copenhagen.

Lastly, we may mention a real bronze button (Plate LV. fig. 19), exactly like our large modern buttons: its shank is well soldered, but not strong, and the disk is very thin. It is perhaps rather an ornament than an actual clasp.

After what is superfluous let us come to what is indispensable. The indigenous fruits were made use of by the settlers for food. We find hazel-nuts, raspberries, beech-nuts, crabs, and stones either of the sloe or the cherry.* At Concise the exca-

* I am reminded by an antiquarian friend that, according to Pliny, the cherry-tree was first introduced into Italy by Lucullus from Pontus. Plin., Nat. Hist. ii. 25. Pliny states that in 120 years it had spread even beyond the ocean into Britain. This, however, can only apply to the sweet cherry.—[Tr.]

vation was made so rapidly, that none of the carbonised wheat could be found, like that of Wangen; neither have we met with bronze sickles, like those so common in the pile settlements of Estavayer and Cortaillod; but probably these evidences that agriculture was then carried on will not be long wanting, as we are already in the possession of the remains of the most important domestic animals.

M. Leuthold, veterinary surgeon at Cossonay, thinks he can distinguish three species of oxen: one a small kind of the size of the cattle of Savoy and the Valais; another larger species; and lastly, a third variety, judging from a tibia, one of the main metacarpal bones, and a rudimentary horn, which appear from their size to be of a different species from our domestic oxen.*

We have met with perfect skulls of the goat and the sheep. Small tusked pigs appear to have been reared in great numbers.

The lake settlers evidently did not neglect game; and wild animals formed their chief resource, and furnished them abundantly with flesh, skins, and furs. We have well-characterised remains of the roebuck and the elk, superb stags' horns, and a skull of the wild boar; very large tusks of this animal are by no means rare.

We have two skulls of the dog; half the lower jaw of the beaver, and two halves of that of the bear. We think that we have also found the skulls of the polecat, the marten, the weasel, and the badger. Lastly, M. Morlot has drawn my attention to the marks of the teeth of rats and mice on several pieces of stag's horn.

The determination of the bones is very difficult; what we have just stated ought to be verified by competent persons, who will doubtless find some new species amongst the bones and the teeth which we could not assign to any particular animal.

The weapons of the chase and of war, together with the female ornaments, form the most perfect specimens left us of the industry of these people.

Two bronze swords were dredged up at Concise in 1832, but only one is now in existence; it is deposited in the Museum of Neuchâtel, and drawn Plate LIII. fig. 17: the material of the blade approaches to bell-metal in colour and hardness; the alloy used for the handle is rather red, and seems to contain less tin.

We have not met with any bronze lance or arrow-heads, but

* Professor Rütimeyer has examined these three bones, and believes them to be those of the common ox.

our flint arrow-heads are remarkable for the beauty of their workmanship, and if they were made on the spot, they show that our lake settlers were fully able to produce good lances and daggers like the specimens from the north shown to me by M. Morlot, the want of the raw material in our country being the only difficulty. Three of these arrow-heads are of new forms, and are drawn Plate LIV. figs. 7, 8, 9; the rest are similar to what have been found in other settlements. The use of the great lozenge-shaped flint drawn Plate LV., fig. 16, is unknown to me.

The bone lance (Plate LIV. fig. 18) and the arrow-heads (Plate LIV. figs. 12, 13, 14, 15, 16, 17) belong chiefly to Dr. Clément of St. Aubin; they are remarkable for the beauty of their form and workmanship. If one of our modern workmen with his steel tools could make them quicker, he would find it difficult to make them better.

In 1832, the fishermen who had found the bronze sword also got up a boat which was simply a hollowed tree. This and the two harpoons of stag's horn, drawn Plate LIV. figs. 26, 27, form the whole of the fishing gear found at Concise; the bronze fish-hooks, both simple and double, now in our collection were presented to us by Colonel Schwab.

I have unfortunately been able to ascertain nothing as to the fishes which were made use of in the lacustrine age; it would, however, be interesting to know whether the great changes which our lakes must have undergone by alluvium have altered the nature of any species, and thus brought about a corresponding change in the aquatic fauna.

A great number of the stones used as corn-crushers have been buried in the embankments of the railway. We found them of different sizes, very like those of Meilen; but I have in vain searched for the pebbles, as large as the two fists, with a little hollow on two opposite sides. Colonel Schwab, who has a large number in his collection, has given us some both from Estavayer and from Nidau. I have not found any of the flat stones which formed the hearths; but cinders and charcoal are by no means rare; and at Corcelettes in particular are met with in considerable quantities.

We have found fifteen of the great clay rings, like those drawn Plate XXXVIII. fig. 14 from Nidau. One is from Concise; the others from Corcelettes, where they are found in abundance; they were used as supports for the cooking vessels when placed in the fire. The material of which these rings

or 'torches' consist can only be explained by the fact of their having been used in the fire. It was in the hearth-fires that they became half-baked. The central part, still black and friable, has been little more than dried; the exterior is red like any other well-burnt clay; but the layer of red colour, which is thick above, and on the outside, where the fire was the strongest, is very thin inside the ring, and especially so below. (Plate LV. fig. 1.)

The cooking vessels are rounded or narrow below, and often have the sides splayed or widened, so as to expose a greater surface to the heat. One of them (Plate LV. fig. 5) is not circular; it might be taken for a pan for frying fish. Plate LV. fig. 4, is the drawing of a great spoon of baked clay with the handle broken. We have quite a series of large porringers, dishes, plates, cups, and drinking vessels. The most remarkable in form and ornamentation are drawn Plate LV. figs. 2, 3, 6, 7, 8, 9, 11 and 12. Three, four, or more varieties may be noticed in the clay used for these vessels. None of it has been washed, and in every instance it contains little silicious pebbles. All the vessels were made of the same clay, the difference arising from its having been taken from different depths. In the pits where the potters dig their clay the quality varies according to the depth; the small silicious gravel is more abundant near the surface.

Clay containing silicious grains, however, was not used specially for the vessels adapted for cooking; some undoubted pipkins are of fine clay, while others of a much coarser kind do not seem to have been used for this purpose.

The little pebbles do not appear to me to have been mixed with the clay expressly to make it resist the fire more effectually. The clay of our modern cooking vessels is what is technically called 'shorter,' and is less pliant than that employed for other kinds of pottery, but the addition of pebbles as big as the end of the little finger would not improve its quality.

To the drinking vessels of pottery we may add three pretty goblets of stag's horn; one like that drawn Plate LV. fig. 10 has been already found at Moosseedorf, but the two others (Figs. 13 and 14) appear to me to be new.

In our modern state of society the division of labour is carried to a great extent, and thus well-executed work is obtained at a cheap rate. It is not so in countries where civilisation is at a low grade; there every individual makes his own tools, and whatever implements he requires.

Our collection contains a great number of specimens which would not require for their manufacture more than a common display of skill, such as sharpened pebbles and coarse pottery made by hand; but there are a considerable number of specimens so well executed that we may attribute them to real artisans who had a special set of tools. This is the case with the hatchets and the hatchet hammers made with the pick and the saw, or perforated with the drill; also with the fine pieces of flint, which are so difficult to obtain by striking off flakes with the hammer; with the beautiful lance and arrow-heads, but especially with the bronzes and pottery.

The imperfect specimens and those which were broken in the process of manufacture, the flint flakes, the 'skulls' or refuse of bronze casting, and the scoria of copper, show that although the details of the work and many of the tools are as yet unknown to us, there was undoubtedly at a very early period an actual manufacture of implements on this very spot, probably before the appearance of bronze. M. Forel of Morges, and M. M. Rey and de Vevey of Estavayer will doubtless describe the moulds for casting hatchets contained in their collections. But few details have to be added to those which Dr. Keller has given as to the pottery.

We have already alluded to the choice and the preparation of the clay for the cooking vessels or pipkins. Some specimens have been made by the hand alone, and others by the potter's wheel; but the quality of the clay has not determined the mode of manufacture. It may be well to mention that the vessels made by the wheel are in general of less coarse clay, but though the little pebbles would make it difficult to work, we possess one in very coarse clay, which has been made on the wheel, while others, either in fine or very fine clay, have been made by the hand alone, doubtless before the potter's wheel was known.

A large number of the bone-points and chisels were used for making pottery. The great ribs with a natural curve (Plate LV. fig. 21) would answer for hollowing out the large vessels in a regular form. One of the sides of a boar's tusk (Plate LIV. fig. 28) is the exact profile of small cups in our possession, and was used for working out the inside evenly. Bone chisels (Plate LIV. fig. 38, and Plate LV. fig. 17) were used for turning the pottery, and when a knife was required it was cut by a boar's tusk (Plate LIV. fig. 29), the enamel of which formed the cutting edge. When something more than the fingers was wanted, the simple ornaments of the period were easily made by

scratching the vessels, when half dry, with the bone points (Plate LIV. figs. 33 and 38). The bone gouge (Plate LIV. fig. 40) was used to make the necks. In order to turn or fashion a vessel, like the beautiful one drawn Plate LV. fig. 3, the potter must have made a piece of wood rather similar to the instrument of bone—half knife, half scraper—drawn Plate LIV. fig. 41. Many potters' tools of the present day are of bone, and are so like those of the lake potters that they might be taken for them. (Plate LIV. figs. 30, 31, 32, 34.) The double pointed instrument (Plate LV. fig. 18) is still employed to make certain ornaments.

All the vessels are imperfectly burnt. The potter's oven was not used. The vessel was placed in the middle of the fire; the outside alone got burnt enough to become red. One of the large vessels we have must have been used as a charcoal brazier, for in the inside we find the red coating indicating that it had been perfectly burnt. The colour of the earthen vessels we have obtained is owing either to the degree of heat they have experienced, to the more or less ferruginous character of the clay, or to the use made of them: the well-burnt part is red, that imperfectly burnt is of a grey black, becoming deep black if when hot it was smeared with grease. It is easy to verify these facts by burning pottery in the manner of these lake potters. I have not been able to find any specimen coloured by 'ruddle' or red pigment, or graphite: one single fragment bears some trace of glaze, which can be easily detached in small scales. M. Bischoff, an intelligent maker of stoves in this town, from whom I have received much information, tells me that he believes common salt will produce a similar glaze.

Many of our lake potters were not only artisans, but artists; their productions are elegant, and of very varied forms; and their ornamentation shows considerable taste. Even the large coarse vessels made by hand have some ornaments, such as the impressions of the finger or the nail round the border or edge, or on the base of the neck; sometimes they consist of little depressions made very irregularly, apparently with a very small wooden point. Circular furrows more or less wide and deep may be seen on the vessels made by the wheel. The little dish (Plate LV. fig. 3), with its circles, its irregularly broken lines, and the double chevrons on its flattened border has a very pleasing appearance.

The bronze objects exhibit a still more remarkable develop-

ment of taste than the pottery: the hilts of the swords, the lance-points, the bracelets, and the hairpins are found in an astonishing variety of forms, and nearly every one of them is of pleasing shape. The plates given in this volume, and still more a visit to the collection of Colonel Schwab or M. Troyon, will show how rich in ornaments were the castings and engravings even for objects of common use. The knife found at Concise (Plate LV. fig. 20) is a beautiful specimen of the shallow engraving of the period, and of designs formed only of straight or broken lines, of circles, spirals, successions of dots, or portions of a circle, all tastefully arranged and entwined.

Amongst the objects found are some coming from a distance which may give us information as to the countries with which the lake dwellers had intercourse. It does not appear that any eatable commodity was imported. The water-chestnut (*Trapa natans*) which was at first thought to have come from the south has been found at Langenthal. But amber and tin have been found nowhere in Switzerland, and probably the same may be said of transparent jade (nephrite) and silicious sandstone (lydite). Amongst the flints found at Concise there are some from the beds of the lower Neocomien, so common in our district, but the finest and most numerous specimens are of the French gun-flint.

We cannot say that any inscriptions have been found; the little indentations, nearly half an inch long, sometimes single, sometimes double or treble, which are seen on some of the handles, are probably only marks of ownership. Our collections have no information to give either as to the language or religion of these ancient people, whose remains were first found at Meilen, as of a fresh Herculaneum; but the fact of their being obliged with so much labour to erect in the water groups of dwellings so difficult of access, indicates a very insecure state of society. The weapons of the chase probably were frequently used also in war.

Many of the specimens mentioned in these notes belong to Dr. Clément of St. Aubin; the others are deposited in the little museum of Yverdon. Dr. Clément was the first who drew attention to the antiquities obtained by the dredge from the lake at Concise; by his zeal and intelligence he succeeded in securing a considerable number, and he kindly threw open the whole of his collection, which has been a great advantage to me in preparing the present report.

L. Rochat.

Yverdon: Nov. 7, 1859.

Besides the antiquities described by M. Rochat, Colonel Schwab has obtained a considerable number from these localities, some of the most interesting of which are drawn on Plate XLVII.

Fig. 3. A thin plate made of cast bronze with a ring at the top for suspension: locality Corcelettes.

Figs. 4 and 5 are bronze knives, of which a great variety found in Western Switzerland may be seen in the collection of Colonel Schwab. The first is from Concise, the second from Corcelettes. They were not formed by the hand of the smith, but were first cast and then sharpened, like our modern scythes and sickles, not so much by being ground as by being beaten near the edge. This mode of sharpening is shown quite clearly in other cutting instruments of the bronze period, as for instance the sickles, the wings of the lance and arrow-heads, and the swords and daggers. The tool drawn Plate XXXVII. fig. 5, from Nidau may possibly have been a small anvil for this purpose. The bronze knives have very rarely the form of those now in use, which either terminate in a point or are rounded off at the end. In general they are curved or sloped like the sabres of many eastern nations, and bent very much outwards towards the point. The spike of the handle and the blade do not always form a straight line. The blade is sometimes broadest near the spike, as in those drawn Plate XLIX.; sometimes in the middle as in the specimens under consideration. When the blade and spike are separated by an intermediate portion, as in Plate XLIX figs. 2 and 11, there is usually a projection running to a point at the beginning of the blade. All the knives are very thick at the back, and are often strengthened like our scythes and sickles by a considerable additional quantity of metal. (Plate XLIX. fig. 10.) The ornamentation, which was preserved so long as the blades were sharpened by beating and not by grinding, is found not merely on the back, but also to a very considerable extent on the flat of the blade; it was made partly in the casting and partly by punching. Most of the knives had handles of wood or horn: some had incisions on the spikes to fix them more firmly in the handle. A few specimens, like Plate XLIX. fig. 14, have the metal part of the handle a broad plate with ridges or flanges at the sides, or have a spike bent round into a ring at the end like Plate XLIX. fig. 10; in the latter case it would do for a cord to pass through, which the owner might fasten to his dress.

Plate LXVII. fig. 8, is a bronze pin, square in the middle and running to a point at both ends; it was found also at Corcelettes.

Fig. 9. Bronze clothes pin with a little cast ring at the top; this was doubtless fastened to the garment with a string. Found at Corcelettes.

Figs. 10, 11, 12, 14, 15, 16, 17, 18, 19, 20. Bronze pins with heads of various forms. It is remarkable that the engraved lines forming the ornamentation are made in a spiral form, not merely on the shank but also on the head, in the pins drawn Figs. 10, 11, and 18. All these pins were found at Corcelettes.

Fig. 22. An implement of stag's horn with a perforated projection on the convex side, probably to receive a string: this was found at Concise. It is rather thick and coarsely worked, so that its use seems somewhat doubtful. Two specimens somewhat similar but much longer and finer are described by M. Rochat, and are considered by him as hairpins, as they are provided with a hole for a string to tie up the hair. (See Plate LIV. figs. 20 and 21.)

Fig. 24. A small open armlet composed of three longitudinal portions; the two outer ones consist of a round wire bent over at the end to the left hand, and thus fastened at this end to the middle portion; at the other end the three parts are rivetted together. It was found at Corcelettes. Lastly, we may mention that a Roman amphora was found at Corcelettes.

GRENG ON THE LAKE OF MURTEN OR MORAT.

This is a large settlement which bears some resemblance to that of Concise. Near the shore nothing is found but implements of the stone age, while farther in the lake we meet with a mixture of objects both of the stone and the bronze periods. It is almost entirely covered with reeds, and is partially an island; when the water is low it can be reached dryshod. The place was investigated in 1861–2, and no small number of stone hatchets came to light, some of them with unfinished perforations. A number of stone hammers were also found, corn-crushers, a stone mortar, six flint knives, clay rings, and fragments of pottery; a bronze ring and a hairpin, several implements of iron, and a great number of bones, some of which had been worked and some were entire. The implement of serpentine, combining the form both of a hammer and a celt, and drawn Plate XXXIX. fig. 5, was found here.

Since then this settlement has been carefully examined by the Count de Pourtalès, the Baron von Bonstetten, Colonel Schwab, Professor Desor, Mr. Jahn, and Dr. Uhlmann. The latter gentleman has given a detailed report of the place, of which the following notice is the substance; it will be seen that the antiquities found here when the settlement was carefully examined, all belong to the stone age.

'On the property of the Count de Pourtalès there is a tongue of land stretching in a northerly direction out into the lake. This place sometime since was thickly covered with reeds and a few willow bushes, and on the average was under water four-fifths of the year. It is nearly of an oval form, and contains about 49,000 square feet covered with piles. The Count is making a small artificial island here, and to obtain material for this purpose, he is employing a mud machine to bring it up from the bottom of a channel formed all round the place, but especially between it and the mainland. By the direction of the Count all the antiquities which were brought up were carefully preserved and now form a small private museum

in the castle of Greng. M. von Bonstetten, Colonel Schwab, and Professor Desor have also obtained here many antiquities.

'The succession of the beds was as follows: First, a layer of broken pebbles and of stones rolled by the action of the waves; then a mass of the matted roots of reeds and rushes (*Scirpus lacustris*, L. and *Phragmites communis*, Trin.), after which the 'relic-bed' was reached at a depth of from one to four feet, containing as usual bones, wood, &c. Beneath this the ground was loamy, and the original lake bottom appeared consisting of diluvial gravel. The piles in general went deep into the loamy ground; they consist of whole oak stems as thick as the arm or the leg, but some which are a foot in diameter have been split in two. In general they are well preserved, and they have been sharpened at the lower end by small, short, irregular, concave strokes of the celt. The wood is black, and has a sour marshy smell like all the mud and sand brought up from the bottom. The piles are placed irregularly: many of them stand close together; in other places rows of quadrangular areas may be seen from twelve to twenty feet in length covered with piles. The antiquities brought up by the mud machine were frequently broken, especially the bones and the more fragile objects; but greater care was taken when a regular excavation was made, and great attention was paid by the Count and his steward, Mr. Gaberel, to preserve every specimen found here.

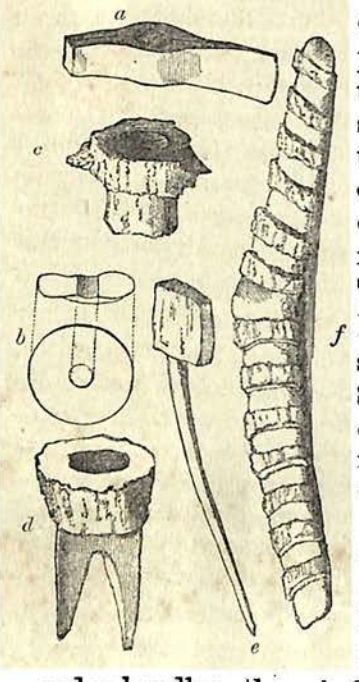
'All the implements found belong to the stone period: no specimen of metal came to light during this examination.

'Some flint dagger-shaped blades of considerable length and most excellent workmanship, chiefly of a black colour, and from five to eight inches long, were found here, as also some implements like chisels and saws, and a few arrow-heads; some flakes and refuse were also met with chiefly of a greyish-white colour.

'Some stone celts of the usual form and size were met with made of felspar and diorite in stone like serpentine; they were not particularly well ground. Others, however, were very carefully manufactured, and both ground and polished all over, amongst which are the perforated celts, serving both for hammer and axe (like those found at Estavayer in the lake of Neuchâtel and in the north); one of them is represented at *a* in the annexed woodcut. Most of these specimens were in fragments; only about five were found whole. They were very neatly bored; the hole is round and everywhere of equal width. There were also found some little disks of stone perforated, and about

1½ or 2 inches in diameter and half an inch thick: the perforation, of a roundish form, is not everywhere of equal width: *b*.

Fig. 9.



'Many of the implements were made of bone. The well-known awls and piercers of various sizes, from 2½ inches to 1 foot in length, and ground to a sharp point, were made chiefly out of the metatarsal and metacarpal bones of the roe, the sheep, the pig, the cow, and the stag, or out of the fragments of bones of other large animals. To these we may add a few dagger-like points made out of the ulnæ of the stag, the wild boar, and the small cow. Small bone-tools, ground square, and chisel-shaped at both ends, were also met with, but not in any large quantity.

'A large proportion of the implements were made of stag's horn. Amongst them are the usual celt haftings, the sockets of which are chiefly made square to fit into the wooden handles: there is frequently a projection on each side as shown at *c*; all of them have been made very carefully with the knife, and very little ground. In some rare cases the socket is bifurcate, as shown at *d*. As far as I can remember, all the celts had fallen out of their haftings. A great number of points and awls, chisels, and spatulæ were made of stag's horn. A very carefully polished hairpin of the same material was found by M. von Bonstetten: the head is flat like a spade or shovel, but smooth and somewhat rounded off; the shank, which is round, is very finely polished, and rather curved; the whole specimen is about three inches long; *e*.

'A very rare specimen, the use of which is problematical, is in the Count's collection at the castle. It has been made out of a stag's horn somewhat curved, and is about 7 or 8 inches long. A portion has been split off on the concave side. The convex side is ornamented in a peculiar manner; a series of furrows or incised portions run across round the whole specimen, and between these furrows there is the natural roughness of the horn; this may be seen in the annexed woodcut *f*. M. von Bonstetten thinks that this object may possibly have belonged to a bow, to

the outer or convex side of which it may have been fastened by a thong which ran round the furrows, and thus bound both together.

'The specimens of pottery found here were chiefly fragments of the red thick earthenware, with grains of quartz in it, made by the hand alone and badly burnt. Some few fragments of thinner ware also occur ornamented with impressed lines.

'A very large quantity of irregularly shaped broken pebble-stones of indefinite size and form were lying all about, which evidently had received their present form artificially. Most of them were rectangular, though somewhat rounded off; from the size of an apple to that of a man's fist. Many flat angular pieces of slate were also met with.

'The quantity of bones was so large that Mr. Gaberel had them carted away by hundredweights. This quantity, however, was chiefly made up of undefined fragments, broken and hewn as if in a butcher's shop. The longer ones are generally well preserved, but not so perfect as those found in the peat-moors. The teeth especially were found in good condition in the jaws, and very singularly are bluish-grey, or sky-blue, or dark blue in colour, especially those of swine; this may be owing to the acids contained in the marshy mud (smelling of sulphuretted hydrogen) combining with iron, which probably is there also, and thus forming phosphate of iron as a colouring material.

'The animal remains are as follows. The bones of the urus (*Bos primigenius*, Boj.) are found only in very small fragments. The remains of a large variety of horned cattle, the domestic ox and cow (*Bos taurus*, probably the *Primigenius* race of Rütimeyer) are found very abundantly. The horn cores, jaws, and general relations of the bones are very like those of our modern larger race of domestic cattle. The very marked form of the small marsh cow is, however, not unfrequent (*Bos taurus brachyceros*, Rüt.). About one-third of the whole weight of bones consists of the remains of horned cattle. On the whole, the sheep cannot be called rare; in general the race has been a large one with extremely strong horn cores, bent backwards and outwards, not unlike those of the ibex. The goat (*Capra hircus*) is found about as frequently, but is more slender in form. The remains of the stag (*Cervus elaphus*) are very abundant, a number of horns were found, the greater number of them perfect; amongst them are some of a strangely monstrous and abnormal form, and others of a very extraordinary size. Some few specimens, such as portions of horns, belong unquestionably to the elk (*Cervus alces*). The fallow-deer has not been recog-

nised here. The roe (*Cervus capreolus*) is of middle size, and is not abundant.

'I do not remember having seen any remains of the horse. The bones of swine are rather plentiful. The great form of the wild boar is easily recognisable (*Sus scrofa ferus*), and so is also that of the marsh pig (*Sus scrofa palustris*, Rüt.), well characterised in old specimens by the short symphysis of the chin, and the general smallness of size. Both of them are found of all ages. Together with these are found a quantity of swine's bones intermediate in size, and of a looser or more open texture, and of molar teeth which are more rugged or protuberant, so that they appear to belong to the tamed or domestic pig.

'Amongst the carnivora, the great bear (*Ursus Arctos*) with its powerful teeth takes the first place, but in the specimens now before me I think that I can only recognise the teeth of the brown bear, perforated and probably used as amulets or ornaments. The remains of the dog are met with of the usual size, but larger than those found at Moosseedorf. They are not quite so abundant as the remains of the bear. A fox of the middle size is rather rare. The hedgehog and the beaver (*Castor fiber*) have been recognised, and the marks of the teeth of mice may often be seen on the stags horns. The small bones of a frog (*Rana viridis*, or *esculenta*?) are unique specimens, and so are the scales of the perch (*Perca fluviatilis*), and of the cyprinidæ, the bleak, and the vertebræ of a large fish, probably the pike. Mixed with the bones and sometimes in the mud found in the hollows of the marrow-bones, I noticed many freshwater shells, probably belonging to the same age, viz., Valvata piscinalis, Planorbis spirorbis, and P. nitida, just as they occur not unfrequently at Moosseedorf. Lastly, remains of human bones have been dug up at several points in the area of the lake dwelling, and at a considerable depth. M. von Bonstetten possesses a perfect frontal bone of a boy hardly come to puberty. In the collection of the Count de Pourtalès there are similar specimens with (if I mistake not) pieces of the cranium; and I have in my possession a left femur and a right humerus, the first that of a middle-sized slender individual, probably a female, the latter of a somewhat younger person. The epiphyses are wanting in these two bones, both above and below, and the ends exhibit clear and indubitable traces of gnawing by some carnivorous animal, but whether by a small bear, or a great dog, or other beasts can hardly be decided. As far as can be judged from a superficial examination none of the portions of the skull

mentioned above exhibit any savage types, for the forehead is regularly arched, and is considerably high.

'The heaps of bones very frequently show the marks of the celt upon them, and also the incisions made by sharp knives, especially the long bones where the ligaments and tendons had to be separated when the animal was cut in pieces. As before mentioned many of them also show the marks of the teeth of carnivora.

'The majority of the piles were probably of oak; there are, however, some of ash, fir, birch, alder, and the common willow. A piece of bast was taken up from a great depth, but fell to pieces in drying. Amongst the other remaining plants may be mentioned hazel-nuts, beech-nuts, the stones of the sloe (*Prunus spinosa*); the bird-cherry (*Prunus padus*); the seeds of raspberries and blackberries (*Rubus idæus* and *R. fruticosus*); the hornbeam (*Carpinus betulus*); the white water-lily (*Nymphæa*); and the strawberry (*Fragaria vesca*); also of a ranunculus. All these are not in a burnt condition. On the contrary, corn, probably the sort known as the lake dwelling wheat, has been found in lumps burnt or carbonised. Burnt masses of vegetable matter and charred wood are not unfrequently met with.

'UHLMANN.'

'Münchenbuchsee: October, 1865.'

MONTELLIER (ON THE LAKE OF MORAT).

Colonel Schwab has obtained in this locality a number of stone implements, such as arrow-heads and flint knives; he also found some hooks, and hairpins of bronze. The most interesting specimens, however, are the earthenware vessels, which are found here in great numbers, and at a considerable depth. A number of various forms and different ornamentations will be found drawn on Plates LI. and LII. All the pottery from this settlement has been made by the hand alone, and not on the lathe, which is shown by there being no parallel striæ on the outside, while inside there are certain hollows arising from the material having been scooped out with a spoon-shaped tool; the sides also are of unequal thickness, and the central point of the base is not in the vertical axis, so that the vessel will not stand, especially if it is more than half full. These vessels have not been burnt in the closed furnace, but in the open fire; so that either one side is red, and the other black, or the upper and lower parts are of different colours; and they do not ring when struck. They are very neatly finished and smoothed, and sometimes they have been rubbed with graphite or charcoal till they shine. The ornaments, which consist of lines engraved more or less deeply, are all filled with chalk. In one single specimen (Plate LII. fig. 12) the ornamentation both on the outside of the bulge, and on the border both outside and inside, consists of strips of tin pressed firmly into the pottery; a similar arrangement has been already drawn in the large earthenware plates or dishes (Plate XLIII. and elsewhere). Only a few of these vessels have any actual foot or base, and those which are not made to stand have the lower part of the walls or sides thin and pressed inwards. The material consists of washed clay mixed in general with either fine or coarse quartz grains.

As may be seen from the specimens we have given, the vessels may be classed as cups or bowls (Plate LI. figs. 1 and 11; Plate LII. figs. 2 and 5); jars (Plate LII. figs. 7, 9, 10); urns (Plate LI. figs. 2, 3, 5, 6, 8, 9, 10, 13; and Plate LII. figs. 1, 3, 12, and 15); basins (Plate LI. fig. 4); jug-like vessels (Plate

LII. fig. 8); and plates (Plate LII. fig. 11). Only the vessels like jars have handles, and only those like jugs have spouts. The oval plate (Fig. 11) was unique.

The line ornaments were made with fine or coarse pins; the impressed dots and rings with an instrument made on purpose. The lines running round the vessels and the hatched ornaments on the bulge are often very close together and have been made with great care, though not always carried out with accuracy.

With respect to the ornamentation in general, we meet with no new forms. Impressed straight and curved lines, rows of points and zigzag lines are found surrounding the vessels even in the stone age. In the bronze age this ornamentation appears richer, and a number of designs are met with such as the meander, the rectangle, the triangle, and the circle. (See the notices of the different lake dwellings, and also the account of the settlement of Ebersberg.) This kind of ornamentation appears most fully developed on the pottery of the lake of Morat; the form is more elegant and varied than elsewhere, though more difficult to make, and it exhibits both taste and an advanced degree of skill. The ornaments as well as the forms of these vessels remind us of the products of the potter's art found in the lake dwellings of the Italian lakes and the Etruscan graves. (See Gozzadini, 'Sepolcri Etruschi').

Only one vessel has a projection on the handle, evidently intended for placing the thumb upon, when carrying it like the horn-shaped or bifurcate appendages drawn on Plate LXI.

Plate LI. fig. 1, is of fine clay of a red colour.

Fig. 2. Has a shining black polish.

Fig. 3. This vessel is of red brown clay.

Fig. 4. Fine red clay.

Fig. 5. Grey and red: very small stones have been mixed with the clay.

Fig. 6. The material is of the colour of the red Turkish tobacco pipes and very heavy.

Fig. 7. A bowl with perforations at regular distances apart; the holes are vertically one above the other, and go through the sides; almost without exception these holes occur as in the present case in horizontal lines which run round the vessel.

Fig. 8. Fine black clay.

Fig. 9. Of a grey colour: the double lines on the bulge, like all the other double lines, are in a depression or furrow.

Fig. 10. Fine grey clay with a deep incised hollow round the neck.

Fig. 11. On the bulge of this vessel there is a trellis-like ornament.

Fig. 12 and Plate LII. figs. 4, 6, and 14. Spindlewhorls (?), of which a large number were found here varying materially both in form and ornamentation.

Plate LI. fig. 13. Red and grey: small grains of stone were mixed in the clay.

Plate LII. fig. 1. The upper part is red, the lower black, the ornaments are unsymmetrical, and have been made by an unsteady hand.

Fig. 2. Richly ornamented, the colour red-brown.

Fig. 3. Reddish: the lines uncommonly fine. Two specimens were found of this form.

Fig. 5. Richly ornamented, the colour red-brown.

Figs. 7 and 9. Two views of a vessel of a black colour. The engraved lines, like all the impressed ornaments, are filled with chalk: the clay is mixed with small grains of stone.

Fig. 8. This vessel has a spout, and the border or rim is strikingly high, almost like a funnel: between it and the body is an incised hollow; the whole vessel has been polished shining black. Colonel Schwab has in his collection two other vessels with spouts from this locality.

Fig. 10. Rather red and black: the clay mixed with fine grains of stone.

Figs. 11 and 13. Two views of a black vessel of an oval form. Chalk is found in the impressions upon it, a proof that it was used for keeping dry stores.

Fig. 12. An ornamented vessel of a shining black colour which contrasts strongly with the tin strips fastened upon it. The black lines in this drawing indicate these strips of tin, and are shown in the enlarged and more correct figure to the left of the drawing; *a*, *b*, *c*, are thicker strips of tin within the border of the vessel.

Fig. 15. Half red, and half black, made of fine purified clay. Ornaments which reach down to the base are very rare.

The following specimens are all from the collection of Colonel Schwab of Bienne.

Plate LII. A. Fig. 4 is an object made of blackish clay like a trellis or lattice: the bars are elliptical in section, one side of them is smooth, the other ornamented with dots and lines. The use of this specimen is unknown.

Fig. 5 is the border of an earthenware vessel ornamented with bands of tin pressed into it; these bands, however, are in relief, as may be seen by the section *a*, *b*, *c*, *d*.

Plate LII. B. fig. 1. A remarkable dish or cup made of clay, coloured black: it is about 15 inches across, and is ornamented on the inside with incised lines; the walls or sides are perforated in thirty different places with double rows of five small holes.

Perforated pottery has been repeatedly found in the lake dwellings, but in no other case are the holes so numerous as in this specimen. The lower figure shows the section.

Other objects of interest, however, besides pottery have been found by Colonel Schwab at this station; the following specimens may be cited:—

Plate LII. A. figs. 1, 2, and 3. Fragments of moulds for casting small bronze rings. Fig. 1 is made of clay; Figs. 2 and 3 are drawings of the same stone, and both sides have been used as moulds.

Fig. 6 is a flint arrow-head.

Fig. 7 is a bronze arrow-head.

Fig. 8 is the fragment of a ring of tin ornamented on the outside.

Fig. 9 is a small armlet or rather a clasp for the wrist made of tin.

Fig. 10 is a sewing needle made of horn.

Fig. 11 is an ornament for suspension made of bronze.

Figs. 12 and 13 are bronze knobs.

Fig. 14 is an ornamented dish of thin bronze plate.

Figs. 15 and 16 are bronze screws.

Fig. 17 is a thin bronze plate.

Fig. 18 is a fragment of a bronze clasp or buckle.

Fig. 19 is a bronze ring.

Figs. 20, 21, and 22 are bronze fish-hooks.

Fig. 23 is a bronze ornament in the shape of a crescent moon.

Fig. 24 is an amber bead.

Plate LII. B. fig. 2 is a portion of a bronze knife.

A singular bronze ring with three ridges running round it was found at Montellier, but by some chance it has been drawn amongst the antiquities of Marin (Plate LXXX. fig. 26).

MORGES.

We are indebted almost exclusively to M. Forel and his son for our knowledge of the lake dwellings and of the antiquities found here. They were first investigated in May 1854, after similar discoveries in the lakes of Zürich and Bienne. The existence of piles here was however previously known, but no one knew what to make of them.

The following is a summary of the reports of MM. Forel on this locality :—There appears to be two distinct lake dwellings : the larger one opposite the town was first discovered, and the smaller one subsequently. It will be better to describe them separately ; the first nearly in the words of M. Forel himself, the second in those of his son, Dr. F. A. Forel.

The lake dwelling opposite the town of Morges is one of the most considerable of all those found on the lake of Geneva. The piles are seen in front of the town 400 or 500 feet from the shore at a depth of eight or ten feet below low-water mark. They are placed irregularly, and cover an area of about 1,200 feet long, by 100 or 150 feet wide. Horizontal beams are found amongst them, some of which have been worked by the hand of man. A canoe may also be seen half buried in the mud ; this canoe is sharpened to a point in front, and apparently is formed of a single piece of wood hollowed out like the 'piroques' of savages : it is hardly more than 2 feet wide.

We have found amongst the piles a large number of antiquities similar to those in the collections of M. Müller of Nidau, and Colonel Schwab of Bienne, now united in the museum of the latter gentleman. Amongst the more interesting are the following :—A great quantity of vessels or fragments of vessels of earthenware of every variety of shape and size. Some are very small and others very large ; in a few cases they measure 2 or 3 feet across. In general they are made of coarse clay mixed with little white pebbles. Some of the small vessels are made of a finer clay and covered with a sort of black polish, the appearance of which reminds one of graphite. Most of them are broken, and this may easily be imagined, for the place where

they are found is frequently worked over by the boat-hooks or iron pikes used by the boatmen. A large number of 'torches' or rings of baked clay have been found here.

The bronze objects are of great interest: about 130 specimens have been obtained, such as celts, swords, knives, sickles, lance-points, bracelets, hairpins, &c. Some of them are beautifully formed and very well preserved.

A mould for casting bronze celts which was found here deserves most particular attention on account of the singular circumstances attending its discovery, and M. Forel's account of it shall therefore be given in full. He says: 'I found the first half on February 25, 1855, and I despaired of finding the remainder till after an interval of four years, my son was fortunate enough to dredge it up October 18, 1859. The two halves agree, and fit exactly to one another.

'The mould itself is of bronze. It is drawn Plate XXXIX. fig. 6, and different views are given, Figs. 7 and 8; it weighs four pounds, and is 7½ inches long. One may recognise at a glance the form of the celts with four wings (fins or projections), which have been found at Morges, Bienne, and other places. On one side it has the hollow for making the loop found on a great number of celts. On both sides of the upper opening for the introduction of the melted metal may be seen two little lengthened hollows, corresponding with the appendages in the form of points, also found on several celts, but which are generally bent down or broken. I have not been able to satisfy myself as to the use of these appendages. The 'adjusting points' of the mould are very well marked; and along the sides of the first half, there may be seen a longitudinal projection corresponding with an analagous groove on the other half; this arrangement seems intended to prevent the escape of the melted metal.

'We have found at Morges forty-two bronze celts of the same type, but of different sizes and patterns. The largest is 7⅔ inches long, and weighs a pound and a quarter. The smallest is 4 inches long, and only weighs six ounces. All these instruments vary considerably, and appear to have been cast in a great many different moulds. The mould we have found would answer for the medium dimension of about 6 inches. At first I thought that many celts of the same size, the shape of which was extremely analogous, had been cast in this mould; but since I obtained the second half, I have cast in it a leaden celt, and I am now convinced that it presents characteristic dif-

ferences. The loop is placed lower, and between the 'wings' may be seen a little projecting cross, which is not met with on any of the celts which we have found. This cross was probably the founder's mark.

'I would particularly call the attention of antiquaries to this mark, as it may enable us to ascertain whether there are any celts in other collections cast from the same mould.

'The wings have been *cast straight* for the sake of being got out of the hollows more easily; they were afterwards curved by means of a hammer. The cutting edge when taken out of the mould would in some degree be thick or blunt; it would afterwards have to be hammered and sharpened on a grinding-stone; the operation of hammering probably helped to harden the metal.

'The first half of the mould shows on the outside some very strange roughnesses or projections in the metal, which I had some difficulty in understanding. At first I thought that they were the remains of a hinge, but nothing analogous was found on the second half; and I have convinced myself that the appearance merely arose from pieces added to remedy defects in the first casting.

'This instrument, which is very remarkable in every respect, is made with much skill and shows considerable dexterity in the art of casting. Was there a permanent foundry at Morges, or did this mould belong to some itinerant founder who travelled from village to village as our tinmen do at present? We cannot decide this with certainty. But what does appear evident is this: as the mould was found at the lake-bottom, the ancient settlement of Morges has probably been destroyed by fire or some other catastrophe. For in any other case it seems likely that an object of so much value would not have been allowed to be lost by carelessness. The great number of celts found at the same time also bears out this supposition.

'I will make two more remarks. First, the piles which have been drawn up at Morges all appear to have been sharpened by small metal celts similar to those we have found. Secondly, if bronze moulds were used for casting such a large variety of celts as we have met with, this fact would indicate a very advanced state of the founder's art; but we may suppose that a part of these instruments were cast in simple earthen moulds and this supposition will reduce the development of industry at this period to more moderate and probable limits.

'I only know of two moulds for casting celts, one found in

England and the other at Quetetot in Normandy. Both these however were for casting socketed celts, and I do not know of any one for making winged celts like ours. It would be interesting to ascertain in what countries similar celts are found. I have seen it remarked that this form is not rare in Italy, but I have noticed none in the collections of the south of France, and I shall be anxious to know whether they are to be found in those of the north of France and of England. I do not exactly know why, but it seems to me that wherever the primitive population of ancient Helvetia may have sprung from, we must always look towards the south to find the starting-point of their civilisation.*

'Amongst the objects in stone is a weight with a hole through it. Several stone disks have been found with a groove round the edge like that of a pulley; also many round stones like little bullets, and other round stones worn on some of their faces. I have not been able to determine with certainty how these different specimens were employed.†

'Several whorls or little disks of baked clay were also dredged up; they are now generally thought to have been whorls for spinning flax or wool.

'Many animal remains were found here, such as stags' horns, bones, and teeth. From all these relics we can prove the existence of the stag, the deer, the goat or the sheep, the horse, and the pig or wild boar.

'We have not found any arms or implements of the stone age, and we have no reason for suspecting their existence; it ought, however, to be mentioned that we have not trenched below the surface of the lake bottom. On the other hand, we have found no implement of iron.'

Such is the substance of M. Forel's report on the large lake dwelling opposite to the town of Morges. This locality was

* Several celt moulds both of bronze and stone are drawn by M. Du Noyer, in the Archæological Journal, vol. iv., p. 327. The bronze moulds are chiefly for casting socketed celts, but there are two stone moulds for making winged celts, both found in Ireland. The ornamentation on some of these celts drawn in this very interesting paper is most extraordinary, and might enable a wayward antiquary to argue that civilisation came from the north instead of the south. Several other celt moulds are mentioned by M. Du Noyer in a note, and much information also is to be found in Sir W. R. Wilde's catalogue of Irish antiquities, and also in the beautiful volume lately published, called Horæ Ferales.—[Tr.]

† The pulley-like stones are evidently the problematical antiquities called slingstones, respecting which some observations have been made elsewhere in this volume, p. 135, though it must be confessed that our knowledge about them is very unsatisfactory. The round stones worn on one or two faces were doubtless corn-crushers.—[Tr.]

also investigated by M. Troyon and Professor Morlot.* They procured numerous clay rings and fragments of pottery, two celt rings, animal bones and charcoal, all of which apparently were similar to the things obtained by M. Forel; but they found also a little object in silver like a necklace bead, which appears to be peculiar, as it is the only specimen of this metal hitherto found here.

The second lake dwelling at Morges has been described by Dr. F. A. Forel, and the following is nearly an entire copy of his report:—

'The smaller settlement of Morges called Les Roseaux is only a few hundred paces distant from the large one opposite to the town which has been described by my father, and yet it differs very essentially from it. Since my father wrote his account, the researches of M. Carrard of Lausanne, and the working of a mud machine on the locality, together with our own excavations, have thrown considerable light on the station; but the problems raised concerning it are still far from being solved.

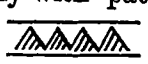
'Alongside of the great settlement of Morges, so rich in bronze implements of nearly every kind, we find a lake dwelling called Les Roseaux, which affords us in fact objects of stone, of bronze, and of iron. The bronze celts and the pottery found here are of quite different types from those of similar materials from the great neighbouring settlement, so that it is difficult to determine its place in the archæological series.

'The specimens found here are the following:—

'Two fine stone celts sharpened and polished, now in the Museum of Lausanne; some flint refuse was also found.

'Fifteen bronze celts of the spatula type, with the cutting edge wide and rounded, and rudimentary ears or wings simply indicated by two small flanges. A celt of this form has been found near the "Pierre de Niton" in the port of Geneva. This form which is very abundant in the south of France is rarer in Switzerland, and yet it has often been found in the remains of lake dwellings. It is similar to those drawn Figs. 2 and 3, Plate LIX., from the Terramara.

'Pottery is rare at Les Roseaux compared with the immense quantity of vessels found in the first settlement of Morges. The vessels met with at Les Roseaux are of two types: one exceedingly coarse with thick walls or sides, the clay of which is mixed with little grains of silex; they recall to one's mind the irregular vessels of some of the stone-age settlements, or the

fragments of pottery found in caverns associated with flint implements; they cannot at all be compared with the very large but extremely well made vases of similar material from the large settlement. The second type consists of finer vessels, better designed and always with characteristic ornaments, most frequently with patterns round the border like the following woodcut  which we have only met with at Les Roseaux. These latter vessels have flat bases, and are totally distinct from the Celtic goblet with a conical base, which as it would not stand by itself had to be placed in a ring of earthenware.

'Several little flat stones rounded and perforated like that from Meilen, drawn Plate III. fig. 13. These whorls are always of stone at Les Roseaux, while in the great settlement of Morges they are of earthenware.

'Many iron sickles of different shapes, some of them like those found in the station of A la Tène or Marin.

'A considerable quantity of bones, the greater part entire and not broken by man, nor has any attempt been made to obtain the marrow; the marks of the knife used when separating the flesh and the tendons may frequently be seen upon them. The species found here are the ox, the bear, the stag, the roe, the sheep, and the marsh pig.

'The piles are of oak and fir; they have been hewn by the bronze celt, and the cutting marks left upon them enables us to decide they were brought to a point by means of the spatula-like celt or hatchet mentioned above, and not by the great bronze celt with ears. We have had the opportunity of examining a considerable number of these piles brought up by the dredging machine, and we have never seen any cutting marks characteristic of the strokes of the stone celt.

'We may add that the settlement is of some extent; it is more than 200 paces long; the industrial relics are not very abundant, and the dredge brings up few remains of pottery and charcoal, indicating that the settlement was not inhabited for a lengthened period. With these facts before us and bearing in mind the value of the antiquities, we have to resolve the following problem: At what age are we to place the settlement of Les Roseaux; and as in the absence of what is positive, archæology is obliged like geology to be content with relative dates, the problem resolves itself into this: Was the station of Les Roseaux anterior to the great lake dwelling of Morges?—was it contemporary with it? or was it posterior to it?

'Was it anterior? The presence at Les Roseaux of stone celts and flint refuse, which have not been found in the other settlement, the form of the bronze celts which approach nearer the shape of the stone celts, than that of the regular celts with ears, and the small advance made in developing the manufacture of bronze, all seem to indicate that it was so. But on the one hand the piles have not been cut by stone celts, and on the other the presence of iron sickles seems to indicate that this station was occupied up to a comparatively late period.

'Is it contemporary with the great settlement of Morges? The presence at Les Roseaux of the three materials characterising the three ages—of stone, of bronze, and of iron, would almost lead us to place this station in the intermediate age, or that of bronze, the stone implements continuing as memorials of past days, and the iron being introduced as a recent acquisition of industry. But how can we then explain the difference in the types of celts and pottery?—how especially can we explain there being no barter or exchange between the two settlements, and how is it that we have never found spatula-like celts in the lake dwelling of Morges, nor eared celts in that of Les Roseaux?

'Is it posterior? The iron sickles and also another piece of iron of indeterminate shape both found at Les Roseaux form rather a large proportion of the few artificial objects found in this station. On the contrary, in the lake dwelling of Morges, so rich in bronze objects, iron is only represented by a single authentic specimen, an iron poignard analogous to that drawn by M. Rabut in his work on the lake dwellings of Savoy (Plate XVI. fig. 1). From this it would appear that the great settlement of Morges belonged essentially to the bronze age, while that of Les Roseaux lasted till the introduction of iron. But this hypothesis is refuted by the presence of stone implements and by the relative imperfection of the pottery, which indicates a low grade of civilisation.

'In fact none of these three alternatives seem independent of criticism; not one corresponds exactly with all the facts observed.

'Two other suppositions may be made to explain the anomalies presented by this settlement.

'Now either the station of Les Roseaux was contemporary with that of Morges, but was inhabited by a race of different origin, having other manners and customs; or by a peculiar caste (such as a sacerdotal tribe), or by a distinct workman's

corporation, for example, of butchers or tanners. In any one of these cases the difference in the type of the implements would be partially explained.

'Or, this station has been a little anterior to that of Morges. The spatula-like celts brought from the south of France had only just taken the place of the ancient stone celts when the settlement was erected. It only existed for a short time; burnt or destroyed by a hurricane it disappeared. The great lake dwelling of Morges was erected some short distance from its site, and its inhabitants or some other colonists before unknown may have come to the locality of the first settlement to gather the reeds which still grow there abundantly; they may have dropped some of their sickles in the water, which may be the very implements we find at the present day.

'We must confess that these hypotheses are of no great value; but still we are obliged to have resort to hypothesis, and we have only to wait until fresh discoveries either confirm or disprove them.

'F. A. FOREL.

'Nov. 10, 1865.'

LAKE OF BOURGET IN SAVOY.

We are indebted to Baron Despine, one of the most active members of the Historical and Archæological Society of Savoy, for the discovery of a lake dwelling in the lake of Bourget. At the meeting of this Society on September 2, 1857, Baron Despine announced that he had observed a great number of piles on the eastern shore of the lake in the bay of Grésine-Saint-Innocent, lying north of Aix, which probably were the remains of an ancient lake dwelling. As on a closer examination numerous fragments of pottery confirmed this supposition, the Baron sent a communication to the French Academy on the discovery of this settlement, probably belonging to the stone period, in the lake of Bourget ('Patrie,' June 30, 1862).

On July 10, 1862, the above mentioned society met together for the purpose of arranging the ways and means for a complete investigation of the settlements in this lake, and appointed a commission to carry on operations in the bay of Gresine. On July 29, M. Rabut Laurent, a member of the commission, communicated the following report in the 'Bulletin de la Société Savoisienne d'Histoire et d'Archéologie,' 1861–2, No. ii. p. 44.

'The commission began its labours under the direction of the Baron Despine, and M. Charles Delaborde. It rocognised traces of habitations in the shape of piles or stakes driven into the whitish clay on an area of about 24,000 square yards, about 220 yards from the shore, and at a depth varying from 6 to 8 feet. The distance between the piles varies a good deal; they are chiefly a yard apart, but frequently interrupted; other pieces of wood are laid across, and remains of pottery might be seen lying about on the bottom of the lake. We set to work to dredge them up, and in a short time filled two boats with fragments of vessels of different forms and sizes.

'The largest of them have a considerable bulge, and are made of red, grey, or black clay, coarsely worked and mixed with small silicious pebbles. Some vessels made of a finer material exhibit small plates of mica. They are often covered with ornaments engraved with a point like the Greek pottery (Plate LVII.

fig. 1.) Others are more simple and widely spread out, and the opening is very broad. Very few are found with handles. Many of these vessels are partially filled with a kind of textile fibre, compact and rather red, but becoming black by exposure to the air.

'Traces of conflagration are found everywhere among these remains: the pieces of wood are half burned; the fruits found at the bottom of the vessels are carbonised, and to this circumstance doubtless we owe their preservation: the vessels themselves have their sides blackened by the action of fire. Ears of barley, acorns, nutshells, rinds of chestnuts, cherry-stones, and grains of millet have been well preserved.

'Amongst the more perfect objects may be mentioned a circlet or ring of earthenware used for the support of those vessels which have a conical base (Fig. 7); a spindle-whorl got by M. Delaborde (Fig. 6); a piercer of very hard wood, well made and polished, but which has lost its original shape by exposure to the air; calcined bones, a stone hammer; and a small bronze ring.

'Can it be concluded from this last specimen having been found here that the settlement was of the bronze age? It is difficult to reply. It may be as well here to mention that several antiquities of the stone age have been found in Savoy, and two may be especially mentioned, now in the collection of Dr. Davat, one a flint knife of a whitish tint found at Hautecombe, and the other a fine hatchet or stone celt made of silicious stone of a rather dark green colour, nearly 14 inches long, found at Chéran.

'The collection of Baron Despine contains a vessel of a very curious shape which was dredged up by M. Delaborde, and which I have drawn Fig. 3, though it does not form part of the collection made by the commission. It has the form of a teapot, is very narrow at the opening and very wide at the base, and is supported by four short rounded feet. On one side it has the remains of a handle, and on the other a little opening closed by a plug of wood charred on the outside. This opening is made near the bottom of the vessel to allow the liquid to flow out. Other specimens of pottery are drawn, Figs. 2, 4, 5, 8 and 9. Fig. 2 is probably a vessel for making cheese; Fig. 4 is remarkable for the rope-like ornament upon it; and Fig. 5 for the ornamentation of impressed dots, resembling in some measure a fragment dug up at Uetliberg. The specimens drawn, Figs. 8

and 9, appear to be beads. All the drawings on this plate have been copied from the work of M. Rabut.

'Other lake dwellings have been mentioned to the commission, amongst which is that of Tresserve in front of Saut de la Pucelle —Dr. Davat believes that a bronze celt in his possession was obtained here—and the station of Conjux at the entrance of the canal of Savières. The traces of dwellings there are numerous, and are well deserving of the attention of the Society.

'The settlement of Gresine was subsequently investigated by Professor Desor of Neuchâtel, but unfortunately the weather was unfavourable and the result was not very productive. One nearly perfect urn, however, was obtained almost a foot and a half in diameter. The fine shape and the ornament on the pottery, together with the general use of graphite, made M. Desor conclude that they belonged to the bronze period, a supposition which is supported by the appearance of the piles and the considerable depth at which they were found. It is striking that hardly any bronze implements have been found in his locality, although the surrounding district has yielded a large number. Dr. Davat's collection contains bronze celts, sickles, and hairpins, all from this neighbourhood.'

LAKE DWELLINGS SOUTH OF THE ALPS.

Before giving an account of the researches of Italian antiquaries on the southern slope of the Alps and in upper Italy, a few general remarks may not be out of place. There can now be no possible doubt that the colonists in these districts lived precisely in the same manner as their kindred races on the other side of the mountains, and that their settlements, like those of Meilen, Nidau, &c., were founded in the stone age, and continued till the beginning of the bronze period; or, to speak more correctly, that the colonists lived here for a long time without any knowledge of metals, that afterwards they became possessed of bronze implements, but that they abandoned the locality before the introduction of iron tools.

It need not surprise us that, immediately after the discovery of the Italian pile dwellings, the question was raised whether the occurrence of such settlements south of the Alps does not warrant the inference that the immigration of the earliest population into the valleys of North Switzerland took place from the south, and not, as has hitherto been supposed, from the east. It is no doubt probable that the mild and fertile land of Italy, especially those tracts open to the navigation of the Mediterranean and thus communicating with the earliest civilised nations, may have been inhabited sooner than the northern slopes of the Alps; and it may be also the fact that mountain ranges have been no greater hindrances to the passage of migratory tribes than dense forests and rapid rivers. This view, for which various other reasons are adduced, is, however, at present destitute of any positive basis, and apparently can neither be affirmed nor denied. The only point which perhaps can be granted without risk is the community of race of the lake settlers on both sides of the Alps.

Another question is, whence the settlers of the lake dwellings, whether on one side of the Alps or the other, first obtained the metals, especially copper, or that metal in combination with tin. Here we meet with several views diametrically opposed to each other. According to one opinion, the inhabitants of middle and

northern Europe, before they knew either how to obtain the metals from the ground, especially copper, or to work them, became acquainted with these materials by barter with the inhabitants of Southern Europe so early advanced in civilisation, and especially with Greece. This assertion rests on the fact, long since recognised as incontestable, that a number of bronze articles found in transalpine countries both in burying-places and scattered over the ground, such as arms, tools, and ornaments, bear the most striking resemblance both in form and ornamentation to the corresponding objects found in Greece, Sicily, and lower Italy, and which may be seen (as, for instance, the swords) represented in the paintings on ancient Greek vases. If we compare the bronze implements of Upper Italy both on this side of the Po, and beyond it, and also the excellent drawings of the contents of Etruscan burying-places, published by Count Gozzadini, with those of the Swiss lake dwellings, such a similarity of form and decoration may be observed between them, as, even if a common origin be not assumed, to prove indisputably a near connection between the civilisation of the founders of the lake dwellings both cisalpine and transalpine with the primitive inhabitants of Upper Italy. (See 'Descrizione del Conte Gozzadini di un Sepolcreto Etrusco scoperto presso Bologna,' Bologna, 1855; with the continuation, Bologna, 1856.) And again, as in the countries of Southern Europe a large number of bronze implements are found of a very primitive form, as, for example, the simple bronze celt copied from the stone celt, it is inferred that northern Europe was at first supplied with bronze articles from the south, until by advancing civilisation the inhabitants succeeded in procuring and working the material, and in rudely imitating southern models. To support this view, attention is directed to the extensive commerce of the Greeks, and to their relations with the Egyptians and Phœnicians, nations early in possession of a civilisation mainly based on the use of the metals.

According to another hypothesis, the tribes who migrated from the east to central Europe, and the northern islands either brought with them a previous knowledge of the metals from their ancient homes, or else acquired it in their new abodes, and beginning with a simple mode of obtaining the ore developed the rudiments of metallurgy independently of any influence from the south.

The opinions just mentioned, and many others, appear in modern works on archæology, and are supported by such erudite

arguments that it is actually more difficult to arrive at a general view of the different hypotheses, than to come to the conclusion that the important questions as to the immigration of the earliest inhabitants of middle Europe and their original condition have yet to wait a long time for their solution.

With respect to the settlement on Lago Maggiore in particular nothing can be more natural than that the excellent quality of the bronze implements found there should lead to the question whether we ought not to assume a direct influence from the civilisation of that nation which so early displayed most extraordinary skill in working bronze, one constituent part of which they were able to obtain by their own labour and the other by commerce with the Phœnicians. This idea occurs the more readily as the lake settlement undoubtedly lies in the territory which belonged in very early times to the Etruscans; and, moreover, at no great distance from it, and nearer to the foot of the Alps, the presence of that people is proved by a burial-place with Etruscan remains; and lastly, Etruscan coins and sacred images have been found in considerable numbers in the Alpine passes themselves and even in the valleys on the northern slopes of these mountains, while an Etruscan work of art has been discovered in a Celtic tumulus. But as the Etruscans themselves migrated into Italy, and that probably by land, perhaps over the Rhætian Alps (See Mommsen, 'Röm. Gesch.' bd. i. 3rd ed. p. 121), and made the first steps towards civilisation under Grecian and Asiatic influences, the discussion of this question must be deferred until we have obtained a larger amount of materials for examination and comparison from the labours of Italian antiquaries who are now beginning to study in earnest the remains of the earliest population of their country.

To the above general remarks it will be well to append an extract from the notices of Mr. Gastaldi, who takes a great interest in the early antiquities of his country, as to the geological position of the peat moors containing remains of human industry found on the southern slopes of the Alps.

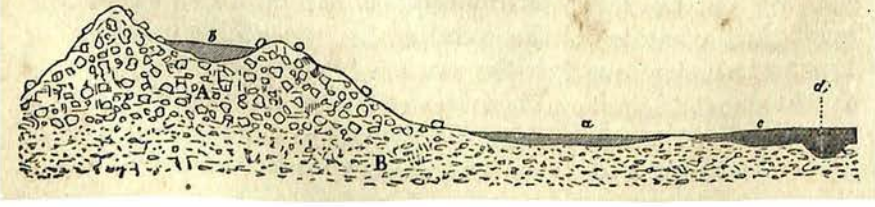
'Amongst the natural beauties with which the fertile country between the foot of the Alps and the left bank of the Po is so richly endowed, the lakes unquestionably hold the first place. All these fine expanses of water, from Lago di Garda, the most easterly of them, to the lakes of Avigliana and Trana, the last of their number on the west, derive their origin from old moraines, between the ridges of which they are enclosed as in an amphi-

theatre. Some amongst these numerous lakes are very small, while others are of great extent. If anyone will take the trouble of examining carefully the districts through which they are distributed—as, for instance, the environs of Avigliana, of Ivrea, of Arona, or of Como—he will soon be convinced that at some period not very distant, the number of the smaller lakes was much more considerable, and the size of the larger ones much greater than at present, and also that the small lakes which have disappeared and the flat shores of the larger ones once covered with water, have chiefly been converted into peat moors. There is no doubt, for example, in Piedmont, that all the peat moors of any extent now under cultivation have been caused by moraines. These moors differ from each other by their elevation above the lake levels, and may be divided into two classes.

'If the amphitheatre, bounded by the ranges of the moraine is occupied by a large lake, as in those of Orta, Maggiore, and Garda, peat moors are found, the level of which rises but little above that of the water, and in a similar way if the area of the amphitheatre is not covered by a large lake, but is intersected by a river, as at Rivoli and Ivrea, the moors are only a few yards above the level of the river. These are the moors which, according to my division, belong to the first class. They are in general of great extent; as, for instance, that of Angera, once a bay of Lago Maggiore, and that of Avigliana connected with the lake bearing the same name.

'The moors of the second class lie in rather contracted basins and at a much higher level, namely, on the ridge of the moraines. Amongst them may be named the moors of Alice, of Meugliano, of St. Martino near Ivrea, together with those of Mercurago, of Aleggio Castello and Borgo Ticino in the neighbourhood of Arona.

FIG. 10.



a. Peat moors of the first class. *b*. Moors of the second class. *c*. A lake covering the area of the amphitheatre. If there is no lake in this hollow, a river *d* runs through it. A. Erratic or boulder formation. B. Diluvium.

It may also be as well here to mention that antiquities, chiefly of the bronze age, are found in the peat moors of Lombardy as well as Piedmont. In 1856 a bronze celt and several flint arrow-heads were found nearly ten feet below the surface in the peat moor of Bosisio: the flint was said to come from the Majolica or compact white limestone, resting on the red ammonite limestone of the mountains between Lago Maggiore and the lake of Garda, but Professor Doderlein thinks it was brought from the Majolica of Enego in the valley of Astico, in the district of Vicenza, where a few years ago it was worked for flints. Bronze implements have also been found in the peat moors of Brenna, and a bronze celt was dug up in a peat moor in the Venetian territory.'

PEAT MOORS OF MERCURAGO NEAR ARONA AND BORGO-TICINO.

Mercurago is a small place which may be reached from Arona by half an hour's travelling. Very valuable discoveries were made here by Professor Moro. Besides weapons and tools both of stone and bronze, wooden implements of various kinds and pottery, he found there a lake dwelling of such a character as clearly to prove that the little lake of Mercurago before its conversion into a peat moor contained similar lake dwellings to those of which remains are now met with in nearly every Swiss lake.

All the particulars respecting this settlement and also that of Borgo-Ticino have been given by M. Gastaldi in his report, of which the following is the substance:—

Several years since antiquities of various kinds were found at Mercurago in digging peat; such as flint arrow-heads, a bronze lance-point (Plate LVIII. fig. 4), a number of earthenware vessels of blackish clay mixed with quartz-grains, also a wooden anchor about three feet and a half long, terminating at one end in two hooks, at the other having a hole bored through it for the attachment of a rope.

In the year 1860 a canoe was discovered for the first time, made out of a single thick trunk upwards of 6 feet long, about $3\frac{1}{4}$ feet broad, and hollowed out about a foot deep (Plate LVIII. fig. 23). In spite of all the care taken by the stringent orders of Professor Moro, it cracked in drying and at length went to pieces. When I saw it the traces of the instrument used for hollowing it out could be distinctly seen in the bottom. Not far from this boat a large bronze pin was discovered (Plate LVIII. figs. 1 and 2), and also a disk of baked clay (Plate LVIII. fig. 15), with a hole in the middle very similar to those found in the marl-pits of the district of Modena and near Imola.

The peat moor of Mercurago is rather of a long shape: nearly all the things found there mentioned by me came from rather a limited space towards the northern end, about 130 feet from the bank, and apparently in a place where the water could

at the most only have been from 7 to 9 feet deep when the moor was a lake. Just at this place in making a trench a row of piles were discovered from 6 to 10 inches in diameter, driven vertically into the greyish mud on which the peat lies (Plate LVIII. fig. 18). The original lake bottom is marked by dark hatched lines: a bed of mud above it is indicated by vertical lines, and the relic-bed lies immediately upon this bed of mud.

Professor Moro having informed me of this discovery, I went with him to Mercurago, where Mr. Maffei, the director of the peat diggings, had already drawn up one of the piles, and we had the opportunity of satisfying ourselves that the tool used for sharpening it must have had a curved edge, for every cut had a kind of hollow.

The piles are from about 5 feet to 6½ feet long; they are driven deeply into the mud, and project about 3 feet upwards into the peat; their upper ends are covered with peat, also about 3 feet thick. An excavation was made here for antiquarian investigation of about 30 feet square (Plate LVIII. fig. 21), and in this space there were twenty-two upright piles bound together by cross timbers. Towards the bottom of the bed of peat, and at the line of separation between the peat and the mud, there is a peculiar layer or bed of fern pressed together, and upon this was found such a quantity of pieces of broken pottery (Plate LVIII. fig. 12, 13, 22), that a great basket might have been filled with them. Also three perfect earthenware vessels (Figs. 14, 16, and 17), a great bronze pin (Fig. 3), rather a long strip of flint (Figs. 5 and 6), with some flint arrow-heads (Figs. 7, 8, 9, 10, and 11), and many flakes of this material, besides a quantity of hazel-nuts, cornel-stones, &c.

It is very evident from all these objects, and from the situation where they were found, that a dwelling formerly existed here, resting on the piles driven into the lake at no great distance from the shore, and that it was inhabited by man before it was covered over by the peat. It is also evident from the occurrence in the same place of worked flints, of rough earthenware vessels in which the clay was mixed with quartz-grains, and of one bronze pin, that the inhabitants lived at a time when bronze was about to be substituted for stone in the manufacture of tools.

The arrow-heads are all extremely well made; the piece of flint above mentioned is 4¾ inches long and nearly $\frac{7}{10}$ths of an inch wide. It is a little bent lengthwise; the lower side is

quite flat; on the upper side there are in the direction of the length two flat surfaces or planes meeting in a kind of blunt angle in consequence of which there is a sharp border or cutting edge on each side. One of these edges has been brought into the form of a saw by means of a succession of blows of the hammer which broke off little scales from the stone. The instrument which was used for this purpose cannot have been anything else but a long piece of flint.

The greater part of the pottery was very roughly worked, and was made without the help of the potter's wheel.

I cannot, while giving this account of the lake dwelling, refrain from adding a short notice as to similar antiquities found in the neighbourhood of Mercurago, but on dry land. On the moraine hill which rises eastwards of this place and stretches down to Borgo-Ticino, fragments of pottery were found in stubbing up brushwood at a place called Il Pennino. These vessels were also made of a blackish material mixed with quartz-grains, like that of the Mercurago pottery, and they almost always contain human bones and sometimes also objects of bronze; an armlet and a pin of this material were taken out of one of these vessels by Professor Moro himself. I learned from the workmen that some years since, eighteen similar vases were found together, and that each of them rested on a slab of stone and was covered by a second. Is it possible that these vases may have some relation with the lake dwelling of Mercurago, and may the heights of Pennino be considered as the burial-places of the latest lake settlers?

If we compare the vases found at Mercurago with those which have been sent to me from Switzerland, dating from the bronze age, the Italian ones appear much rougher both in workmanship and in material: the sides are much thicker, and consequently the vessels are proportionably heavier. Some of the fragments have a degree of ornamentation, but this is of the most simple kind, only scratched lines or impressed touches made on the clay while yet soft. The pattern or mode of ornament consists of the usual zigzag markings, each series of which is accompanied by a row of parallel lines. A later excavation than the one already referred to, brought to light more of this ornamented pottery, very like what is found in other similar localities, and also two perfect earthenware vessels of dark clay with the remains of cords still attached to the handles.

Two of the most remarkable things found at Mercurago are of wood and resemble wheels. That drawn Plate LVIII. fig.

20 was found first: it is not quite circular. In the middle there is a hole for the reception of a tube in the form of a nave. Between this and the circumference are two openings of the shape of a half moon. The whole consists of three boards probably of walnut-wood, and is held together by two cross bars meeting in the middle of the circumference and dovetailed into the boards. These cross pieces are however not placed in a straight line, that is parallel with the diameter of the wheel, but bent to such a degree as nearly to run parallel with the circumference; when they were fitted, to accomplish this they must have been made flexible; they are of larch-wood, and charred on the under side. Professor Moro, who found that it was impossible to preserve wooden objects from the peat bogs except in water, sent me this disk in a moist state to Turin, where it was carefully modelled in plaster of Paris.

The second wooden wheel is drawn Plate LVIII. fig. 19, it has six spokes, two of them made out of the same piece of wood as the nave, the other four are fastened into the central piece and the fellies. The different parts of the wheel itself or the fellies are mortised together by pieces of wood let into rabbets. These holes or rabbets are made with the greatest nicety, and prove that an instrument with a curved edge must have been used to cut them. The portion of the wheel marked *a*, *b*, is in one piece, and like the remaining parts of the circumference, appears to be of walnut-wood. Not the slightest trace of metal is to be found in the whole wheel.

Earthenware vessels precisely like those of Mercurago are found in the peat bog of Borgo-Ticino, which belongs to the first class and lies at the level of the Lago Maggiore.

A great number of earthen vessels, of flint arrow-heads; and some objects in bronze were found in the moor of Gagnano, situated a short distance from those just mentioned, but they were all dispersed or thrown away. On the bank of this basin I have seen piles almost identical with those of Mercurago, the only difference being that they were sharpened by fire at the lower end. I have noticed that charcoal and ashes, as well as wood that had been worked by human hands and trunks of trees partially burnt, are very commonly met with in the peat moors of Arona and Ivrea. The stems of trees found in abundance in these moors belong to the following species:—Italian pine, oak, alder, birch, willow, walnut, all of which, as it appears to me, have grown on the spot. Only twenty years since the peat moor of Gagnano was pasture land, but now that the peat

has been cut away to the depth of 16 or 18 feet, the moor has again become a lake.

In the neighbouring moor of Conturbia remains of later date have been found. Nearly in the middle of the moor there are a number of piles driven into the peat which, according to the account given by the manager, had the lower end furnished with an iron point. I managed to procure one of these piles; and there was no iron on this one, but I was quite convinced that it had been sharpened by instruments similar to those in use at the present day.

PEAT MOOR OF SAN MARTINO AND TORRE BAIRO NEAR IVREA.

This moor lies on the ridge of a moraine, in fact just where, near Ponte dei Preti, the straight line of the lateral moraine begins to bend so as to form the terminal moraine. The basin thus enclosed is nearly oval: its greatest breadth is about a mile and a quarter, but in some places it is only five furlongs across.

Surrounded by meadows and fields, interspersed with groves of high trees, and with the small village of Giovanni, to the north surrounded by chestnut and walnut-wood, this basin has a quiet and picturesque appearance, a thing very unusual in the peat districts.

No remains of regular piles have as yet been discovered in the moor of San Martino which indicate positively the existence of a lake dwelling in the ancient lake; but still within the last few years two earthenware vessels and a worked flint were found there. One of these vessels (Plate LXV. fig. 1), which is in my possession, shows no marks of the potter's wheel, and is of very rough workmanship, although some rude attempts at ornamentation may be observed in a series of deep impressions, about an inch and a half below the rim, made by means of a piece of wood or stone. The shape is nearly that of a cylinder, rather diminishing towards the base. The material is exactly like that of the vases of Mercurago, and consists of blackish clay mixed with quartz-grains The fact of antiquities of this kind being found in the moor proves that a Celtic race once had a settlement on the border of the former lake of San Martino, and makes it almost certain that the lake dwelling itself will soon be discovered. Besides this weir baskets or fish-traps, made out of osiers, have been found about a yard deep in this as well as in several of the small moors of the neighbourhood. The bronze sword from the Lago di Viverone, Ivrea (Plate LXV. fig. 2), may be compared with some of the bronze swords found in the actual lake dwellings.

The peat moor of Torre Bairo contains fragments of earthen vessels which appear to have been made by the wheel, and a small millstone has been found in another moor. We must not omit to remark that great care is necessary in determining the age of the antiquities found here, for though the neighbourhood of these moors, judging from the objects found in them, was evidently peopled in prehistoric times, yet there can also be no doubt that these localities were afterwards densely inhabited in the Roman period: this is proved by the number of brick graves containing vases of a very different character, which are frequently discovered in stubbing up bushes.

LAKE OF VARESE.

In the year 1863 the Abate Professor Antonio Stoppani, discovered five lake dwellings in this lake; a sixth was subsequently found by the Abate Giovanni Ranchet.

1. Isolino, the largest settlement, with numerous piles. The antiquities found here were flint knives, worked bones, and a number of fragments of bones of the stag, the goat, the ox and the pig; also spindle-whorls and pottery.

2. Cazzago, a lake dwelling, but not of much interest.

3, 4 and 5. These three stations are all near Bodio. The most easterly of them has been called Keller, that to the north-west has been named Desor, and that nearest Bodio, the central station. Of these three that near Bodio is the richest and the most important. A number of arrow-heads and some axes of flint were found there, spindle-whorls of sandstone, a ring made of quartz; some fragments of pottery and a few bronze implements, amongst which are a pin, some fish-hooks and two lance heads. The station called Keller is a repetition of that of Bodio, with the exception of the bronze implements; a number of arrow-heads were found here barbed and of excellent workmanship. In the station called Desor pottery is very abundant.*

6. Bardello is a station of small importance.

(See the 'Rapporto sulle Ricerche nel Lago di Varese,' by the Abate Antonio Stoppani, 1863.)

* Some of these settlements, it appears, have been named after the Swiss savans.—[Tr.]

LAKE DWELLING OF PESCHIERA ON THE LAKE OF GARDA.

The discovery of this settlement is of considerable interest, as from its geographical position to the south and east, it shows that the tract of country where the phenomena of lake dwellings are observed is more extensive than was at first supposed. Together with the settlements of Mercurago, of Castione, and those of the Savoy lakes, it proves that the lake dwellings south of the Alps were founded in the stone age, but were not fully developed till the period of the common employment of bronze. And with respect to the general history of civilisation, it opens to us a view of the connection between the settlements of Switzerland and upper Italy. For it may be remembered that the bronze implements found at Peschiera differ very little from those destined for the same use found in Switzerland; or, to speak more correctly, most of them agree so completely with the objects got from the lakes of Neuchâtel and Bienne, and now preserved in the collection of Col. Schwab, that we cannot deny that there must have been an active traffic between the settlements on both sides of the Alps, a mutual influence and a similarity of civilisation between the two.

Amongst the number of objects which were forwarded from Peschiera to Zürich, and which of course are only a small portion of the things obtained there from the bed of the lake, there are several implements of metal not made of bronze, but of copper, and, as we shall see, identical both in material and shape with those found on the mainland in the east of Europe. These copper implements induce me to call the attention of antiquaries to a fact which has hitherto remained without attention. In all the works which have come before me, treating of the development of civilisation and the introduction of metals in the western countries, it is affirmed that the use of copper necessarily must have preceded that of the mixture of this metal with tin, that is of bronze: but notwithstanding this, and even though copper tools are occasionally met with though very rarely, yet that a copper age has never existed in Europe

for the transition from pure copper to bronze did not take place in Europe. This assertion is partly correct with respect to western Europe, but not for the whole of the continent, and more especially not for the east of it, such as Hungary and the countries lying east and south of it. My friend, the late well-known mechanist, Mr. William Fehr, during a residence of many years at Pesth, directed his attention to the implements of the early ages found richly developed and in incredible numbers in the country of the lower Danube, which are accumulated in the museum at Pesth, in private collections, and in the shops of the dealers in antiquities. He assured me that in certain localities of Hungary copper implements are just as plentiful as those of bronze: and he presented to the Zürich collection some hundred specimens, amongst which a considerable number are of copper. The facts, that the very largest and heaviest tools were made of pure copper and also that cutting instruments like axes were of the same material, indicate on the one hand a considerable abundance of copper, and on the other the original non-existence of bronze.* From the information which our friend was able to give we may conclude with certainty that copper was used by one of the earliest populations of those countries for implements of war and the chase, for those of husbandry, domestic economy, and ornament; and that it was employed for these purposes during a lengthened period. For the sake of comparison, sketches of a number of these bronze objects from Hungary are given Plate LXVIII. figs. 1 to 28.

The appearance of copper in such quantities in these districts involves the discussion of the question to what nation these implements belonged, and further whether these people made them themselves or obtained them from other races either to the south or the west. But the primæval history of Pannonia and Dacia, like that of western Europe, is shrouded in darkness, and so is the period when some light begins to appear and the names and races of peoples are known, and the time is hardly

* According to the accounts given in the 'Archaeologiai Közlemények,' implements of bronze as well as of copper have been found in the districts (comitaten) on both sides of the Danube, in the countries of the Pannonians, Iazyges and Dacians, and in many places, for instance at Ipoly-Damasd, in the district (comitat) of Hont, and at Parndorf, in the district of Moson, they occur in great abundance and variety of form. As moulds for casting were also found there, these bronze implements were believed to have been made in the country itself by some of the Celtic race who had wandered there. In the atlas given in the Archaeologiai Köslemények, which contains very good drawings of the copper and bronze implements found in Hungary, by far the larger number of the weapons, tools, and ornaments are marked as consisting of copper.

more clear, when copper was exclusively in use. When the districts south of the Danube, when Turkey, Greece, and the countries bordering on the Black Sea have been more closely examined as to the remains of their earliest civilisation, it will then be more possible to determine whence these implements came and by whose means they were brought into the districts under consideration. Sufficient has now been said merely to notify the extensive diffusion of copper in Hungary.

Unfortunately the information as to the settlement of Peschiera is not, as is the case with some other lake dwellings, based on a careful investigation of the locality. All the information we possess respecting it has been kindly communicated by M. von Silber, first lieutenant of the Austrian corps of engineers at Verona. He discovered the place and secured some of the objects found there, which he kindly forwarded to us together with the following report as to the locality and the circumstances under which the discovery was made.

'In deepening the entrance of the harbour of Peschiera for the newly-built gunboat, which was done by means of a mud machine (called a *paternoster*), to a depth of seven or eight feet below the usual level of the water, the workmen found amongst the mud and sand brought up by the machine, a great number of bronze implements. These were carefully preserved, for the sake of archæology, by Mr. Lorenz, the marine engineer now residing at Pola, and myself. I was so uninitiated in this science, that when I found that the greater part of the objects had been taken up from a space of a very few square fathoms, I had the notion that a ship laden with bronze had been wrecked here, and it was not till a conversation which I had with Dr. Freudenberg, of Bonn, that I was led to believe that a lake dwelling probably existed on this spot. This idea was corroborated by the fact that, just in this place, the working of the mud machine was very much impeded by a number of burnt piles which were quite covered with the mud. Unfortunately, I fancied at first that these piles came from the fishermen's huts, which abound in this neighbourhood at the present day, so that I paid no attention to their position or arrangement. The piles which were drawn up were, on an average, four or five feet long, quite hidden under the sand, and burnt to such a degree that it is quite impossible for me to say with certainty what kinds of wood they were made of. I imagine, however, that the wood was chiefly that of the stone oak (*Quercus ilex*). The piles were four or five inches in diameter.

'Besides the bronze implements one of stone was found, which I believe to be a sling-stone. Lately, when reading the reports of the Swiss lake dwellings, I remembered the occurrence of a great number of pieces of burnt clay found in the mud. These pieces were of a blackish colour, remarkably thick, and without any definite form. I do not doubt that they have been fragments of the clay covering the huts of the lake dwellings.'

The objects found at Peschiera are drawn in the following plates:—

Plate LXVI. figs. 1, 3, and 4 appear to be daggers; 2, 5, 6, 7, 8, 9, spear-points—similar objects to these last are found in the Swiss lakes; 10, 11, 12, 13, 14, 16, 17, 18, 19, 20, 21, 22, hairpins and clothes pins; 15 and 23 are sewing needles. The whole of these are of bronze, and many are very similar to specimens in the collection of Colonel Schwab, of Bienne. Plate LXVII. figs. 4, 11, 12, 13, 14, hair or clothes pins; 1, 2, 3, small harpoons; 5, great clasp, or armilla, ornamented with engraved lines; 6, 9, spirals; 7, 8, fibulæ; 10, knife, the handle broken off; 18, tube, with engraved spiral ornament; 19, chisel. The whole of the above are of bronze. Figs. 15, 16, 17, copper chisels; 20, disk of granite (sling-stone?); Fig. 21 gives a plan of Peschiera, where the Mincio joins the lake of Garda: the locality of the lake dwelling is marked with †.

Since the above account was written, Dr. E. Freiherr von Sacken has published a full report of this station, taken chiefly from the account given by Captain von Kostersitz who was present at, and carefully watched, the excavations in the years 1860, 1861, and 1862. The area examined by the machine up to 1865 consists of about 2,650 square fathoms. Numerous piles were found placed irregularly, which had been driven from three to six feet into the mud. The depth of water is about five feet. Large quantities of pottery were found of the usual forms, and a number of bronze implements, such as celts, lance and arrow-heads, knives, sickles, awls, and pins.

Professor Abate Stoppani has also discovered five other stations on the lake, namely, two at the island of Lecchi, and three at St. Felice. (See vol. vi. degli Atti della Società Italiana di Scienze Naturali, Seduta del 3 Aprile 1864.)

LAGO DI FIMON, NEAR VICENZA.

In the year 1864, Signor Paolo Lioy discovered oak piles, the ends of which had been burnt, in the moory bed of the little lake of Fimon, south of Vicenza; at the same time he found parts of the clay coverings of the huts. This gentleman thinks that he has also found traces of the huts themselves. The implements all belong to the stone age, and consist of knives and lance heads of flint, hammers of limestone, various forms of bone implements, and a great quantity of pottery. Some idea of the food of the colonists may be obtained from the examination of a mass of broken bones found here; they belong to the stag, the roe, the sheep, the pig, and different varieties of the ox. There were also numerous shells of the fresh-water tortoise (*Emys lutraria*). Amongst the remains of the vegetable kingdom there were acorns, cornel-stones, cherry-stones, hazel-nuts, and water-chestnuts.

CASTIONE AND THE MARL-PITS OR TERRAMARA BEDS.

In the provinces of Parma, Reggio, and Modena, there are to be found in many places considerable beds of a yellow-brown or brownish-black earth rich in animal substances and used for agricultural purposes. This earth is commonly called *marl** (mergel, marna, &c.), but by Venturi it is named *burial earth* (terre cimiteriali).

In these marl-pits are found antiquities of various dates,—pottery, implements and coins, &c., of the Roman period; weapons, implements and pottery of an earlier period; and lastly,

* The word 'marl' is here used for want of a better: but it must not be confounded with our English marl, the composition of which, it will be seen, is of a very different character.—[Tr.]

human bones as well as those of oxen, stags and pigs all mixed up in abundance with ashes of charcoal and burnt corn.

Venturi classes these beds of what he calls 'burial earth' under three divisions. The first, according to him, contains traces of the burial places where the Boii, a Gallic race, laid their warriors who had fallen in battle, or the relics of cremations and sacrifices of that age: the second contains remains of Roman graves; while the third exhibits those of ancient buildings destroyed by fire or some other calamity: the account of one of these dwellings, that of Castione, shall be given nearly in the words of the antiquaries who discovered it.

Cavedone, in his description of a sword found in the marl-pit of Marano (Indicatore Modenese, anno II. n. 18), partly agrees with Venturi's opinion; but he directs attention to the fact that different layers are clearly to be observed in the marl-pits, separated by beds of gravel, fragments of tile, and common earth. Neither of these gentlemen, however, have remarked one main point, and that is, that in by far the greater number of the marl-pits, the objects are not found as they were originally deposited, but where they were brought down by floods. For it has been ascertained that all the marl-pits in the above-named localities occur either in the neighbourhood of torrents or in places subject to the inundations of the Po.

From the information obtained in various quarters as to these singular deposits, it may be asserted that the greater part of the marl-pits contain the remnants of Roman graves and also the remains of interments, of cremations, and perhaps of the refuse of feasts of the people of the bronze age.

Amongst the remains of Roman graves may be noted the fragments of tiles used for making the tombs containing sepulchral urns, also lamps, the objects called lachrymatories, coins, and a variety of implements belonging to this period, and other objects washed down into the marl-pits by flood and, in some cases, found there in considerable quantities.

The remains of burials of the bronze age may be recognised by the bronze swords, lance-points, wedge-shaped celts, as well as those with shaft-flanges, arrow-heads and fish-hooks: all of which are found together with stone weapons and tools, especially flint arrow-heads, the whole mixed with ashes, charcoal and human bones; also with very roughly worked earthenware vessels, badly burnt, of a black or dark red colour, the material of which is mixed with quartz grains; and lastly with spindle-whorls of burnt clay generally found so abundantly with remains of the bronze age.

The opinion that the marl-pits contain the remains of the ancient inhabitants of the country is borne out not merely by the great mass of bones of oxen, stags, swine, &c. found in them, but chiefly by the fact that the long bones of the extremities are broken at one end, just in a similar way to the bones of the larger animals found in great abundance in the 'Kjökken-möddings' (see A. Morlot, *Études géologico-archéologiques*, Lausanne 1860), and in the lake dwellings of Switzerland. These bones were evidently broken for the extraction of the marrow, just as the Greenlanders and Laplanders of the present day break the bones of the reindeer.

After these general remarks, it will be well to give nearly entire the report by Mr. L. Pigorini and Professor P. Strobel on the Terramara beds in general and on the lake dwellings of Castione in particular. This report has been printed in the valuable work by Signor Gastaldi before referred to (*Nuovi cenni sugli oggetti di alta antichità trovati nelle torbiere e nelle marniere dell' Italia.* Torino 1862, in-4to, with six lithographic plates and woodcuts).

We will begin this notice by giving our reasons for the adoption of the terms Terramara and Mariera for these singular deposits. The expressions used by some scientific people, Terramarna (marl earth), Marniera (marl-pit), Terra cimiteriale (grave earth), have given false ideas of its nature both at home and abroad in a mineralogical as well as an agricultural and archæological point of view. By marl (marna, marne, &c.) is always understood a limy substance naturally containing clay, that is without artificial means, and which can be used for the (mineral) improvement of the soil, in fact for 'marling.' The Terramara full of works of human art may contain both clay and lime, or it may consist more or less of clay containing lime,* but these are not its distinctive characteristic component parts: on the contrary, the phosphates and the organic matter (which are wanting in the true marl) make this earth extremely valuable in

* The following are the chemical analyses of this earth from two different places, made some years ago by Professor Truffi:—

Constituents of the earths.	From Casaroldo.	From Noceto.
Clay	070·030	045·470
Carbonate of lime	022·020	013·960
Sand and other mineral detritus	003·900	033·180
Organic matter	002·820	004·300
Phosphoric acid	000·180	000·240
Mineral materials soluble in water, and loss	1·050	2·850
	100·000	100·000

agriculture: it is, however, exclusively used for the (organic) manuring of meadows: if put on arable land, it burns up the seed.* The name of 'grave earth' is too exclusive, and gives a partial view: that is, it presupposes a mode of origin which is by no means admissible, at least for the greater part of the localities named. Now our country people call this questionable earth Terramara, probably a corrupted form of the expression Terramarna, but possibly also the genuine ancient name; for Ghiozzi, in his treatise on Julia Fidentia,† says that the earth derived its name of Terra di mare (sea earth), because it was imagined, though incorrectly, to have been a deposit of the sea. However this may be, the expression is not newly coined, and it has the advantage of giving no false ideas; the authors of this report, therefore, have considered it better to give it a preference over the others, and they have ventured also to derive from it the word Mariera.

This report is divided into three parts. The first treats of the productions of human art; the second of the organic remains; and the last of the origin of the Mariere or terramara beds.

I. REMAINS OF HUMAN INDUSTRY.

Amongst these the most interesting are certainly the pile dwellings. That we are now about to describe was found near the small convent of Castione, in the district of Borgo San Donnino, in the province of Parma. The part of it hitherto exposed is about nine-tenths of an English acre, but it probably extends over the whole area of the little hill standing there, containing about five acres or the greater part of it. In order to gain as good an idea as possible of the dwelling and of the terramara resting upon it like a little hillock, let us imagine a little hill about ten feet high rising out of a plain, and surmounted by a kind of cloister castle, an ancient monastery (conventino). The top of this rise is formed of vegetable mould, below this is found the terramara, and the piles are met with underneath. If we ima-

* A classical friend suggests whether the name for this bed may be derived from 'terra amara,' and he refers to Virgil, *Geor.* ii. 238.

'Salsa autem tellus, et quæ perhibetur amara,
'Frugibus infelix.'

The fact mentioned in the text of the terramara burning up the seed if used on arable land, seems to agree with 'frugibus infelix;' but I am informed that this derivation has been proposed, and is not accepted by the Italian antiquaries.—[Tr.]

† Memorie Storiche sulla Fondazione della Città di Giulia Fidenza, Edizione 2ª, Borgo San Donnino, 1840.

gine a vertical section, taken diagonally, of this hill and the ground below it, down to the points of the piles, it would approximately be as follows :—

1. Alluvial earth	6 ft. 6 in.
2. Terramara	8 ft. 1 in. (see *d*, Pl. LX. fig. 1).
3. Black peaty marl earth, or marly peat earth, formerly marsh water	3 ft. 3 in. (see *e*, ditto).
4. Greenish-grey clay marl, the ancient bed of the marsh	(see *f*, ditto).

The beds, Nos. 1 and 2, naturally diminish in thickness as the hillock slopes off all round towards the plain. The piles, for the greater part of their length, are in the third bed; on the average their heads or upper ends are about three feet below the level of the plain, and the terramara goes down to about five feet below it, so that it lies partly above and partly below the level of the plain. The piles are driven more or less deeply into the marl-bed, and at the present moment bend towards the east-north-east in consequence of a pressure coming from the west-south-west, probably from the terramara beds lying above. They stand, some singly, some in groups of three together, and at very various distances (Plate LX. figs. 1 to 5); they are from 7 to 10 feet long, and their diameter at the top is from 4½ to 7 inches. On the piles are laid the beams from 7 to 10 feet long; they lie at different distances from each other, according to the length and breadth of the dwellings, and join each other at right angles. Some simply rest on the piles or the beams on which they join, others are either let into a mortise, or furrow, cut into the head of the pile, or are forced through a four-cornered hole cut under the head. On this scaffold of beams lies the board flooring, made of a single layer of boards, 6½ feet long, from 6 to 13 inches broad, and from 1¼ to 1½ inch thick (Fig. 3). Lastly, on the whole is the actual plaster flooring, consisting of a bed of yellowish clay marl (perhaps taken from the ancient bed of the marsh), about one foot thick; the upper surface is smooth and tolerably firm, probably made so by being beaten, or by means of fire. Towards the top there appear regular layers of gravel and clay, as shown Fig. 2, *a* and *b*, and below this at *c*, is a thin bed of decayed and charred wood. As yet no certain indications of the plan of the huts themselves have been found; it may have been that they were burnt down, for traces of fire are very evident. The piles appear to have been sharpened entirely with the celt or axe, and not by means of fire. The stems were not split, but used

whole; they are chiefly trunks of elm and oak. Unfortunately the greater part of the dwelling which had been exposed after the terramara had been carted away, was again covered with agricultural earth and sown with maize. Only the portion lately excavated containing about 420 square feet, and about 7 feet deep, could be taken under consideration, and the results of this excavation alone are here brought forward.

As in the Swiss lake dwellings, some remains of the walls of the huts have been found in the Mariere, in the shape of pieces of half-burnt clay, with impressions of wattlework; these evidently formed the covering of the walls, and probably belonged to those parts nearest the hearth, as the fire had burnt the clay; the other parts of the huts not having been burnt have probably decayed away. Pieces of plaster flooring, like that of the lake dwelling just described, were found in the terramara. A very singular hearthstone was lately discovered (Plate LX. fig. 6); it is of unwashed clay, like that of the great spindle-whorls, and what have been called the 'fire cones' of the Swiss lake dwellings, not yet found in this district, and like them it has been worked without any particular care. Small holes have been bored in a row along the edges of the two larger surfaces, which, at least in some cases, reach from one side to the other. On one of the surfaces slag-like blisters may be noticed, so that this stone has been exposed to a very strong fire, and there may be a question whether it belonged to an oven for baking, or to a smelting furnace.

Fragments of what are called Celtic vessels are dug out of the Mariere by thousands; some smaller ones have been found entire. The largest of them yet found is about 5¾ inches high, and its greatest diameter is 7 inches; it is of a spherical form with five knobs placed around the bulge (Plate LX. fig. 7). The very large vessels, of which hitherto only fragments of various sizes have been found, had somewhat of a conical form, but with a bulge below, and usually had either vertical or horizontal handles. The smaller vessels varied very much in shape: some were like our dishes, cups, basins, or flower vases; some resembled bowls, saucers, &c.; and some of them, in spite of the rough workmanship, were not without ornament (Plate LX. figs. 7, 8, 9, 10, and Plate LXI. figs. 1 and 2). It is very singular that in Casola, a small town in the Apennines of Parma, earthenware vessels are still manufactured, resembling the simple ordinary earthen vessels found in the Mariere, both in the material, which is clay mixed with half-burnt limestone,

or 'tarso,' and also in shape, and which likewise have neither been turned on the wheel nor burnt in a furnace. They stand the fire better than the usual earthenware vessels, and consequently find a ready sale in the neighbourhood.

Some of the vessels of the terramara have no handle, nor anything which would do instead: others are ornamented with five or six little knobs round the bulge, and in several instances one of these knobs has a hole through it, by which the vessel could be hung up (Plate LX. fig. 7). In some of those without knobs, a hole near the edge may be noticed, evidently for the same purpose, or one or two little ears (Plate LX. fig. 9), like the vessels just mentioned from Casola. But a large proportion had regular handles, in fact, the ancient potters of the terramara, contrary to the custom of the Swiss lake settlers, seem to have stretched their fancy and developed their art chiefly upon these parts of their vessels; and, for this reason, it may be advisable to examine the matter a little more clearly. The appendages (*ansæ appendiculatæ*) attached to the tops of many of the handles, are especially of the most varied forms (Plate LXI. figs. 3 to 10). Sometimes they represent two stag's horns joined together at the bottom, or one of the shape of Fig. 3 (*ansa cornuta*); sometimes a half moon (*ansa lunata*) (Fig. 4); sometimes they have the form of hare's ears (*ansa lagotis*) (Fig. 5); sometimes of two curls opposite to each other (*ansa cincinnata*) (Fig. 8); sometimes they take the form of lancet-shaped leaves (*ansa lanceolata*) (Fig. 9); and there are sometimes two knobs, more or less developed, one on each side (*ansa bituberculata*) (Fig. 6); or they form a cross-piece on the appendage (*ansa transverse appendiculata*) (Fig. 7). In many cases there is only one appendage to the top of the handle (*ansa monoappendiculata*), as shown in Fig. 10.

Amongst the various rims or borders of the vessels, a few deserve mention which, like many of those from the Swiss lake dwellings, evidently bear impressions of the potter's fingers; others with the edges turned up are ornamented with engraved lines. The greater part of the vessels have no projecting foot; the bottom itself, being generally flat, answers the same purpose. The ornamentation, though simple, and for the most part in straight lines, is not without taste, in many cases engraved, sometimes also inlaid with bronze (Plate LXI. fig. 12), frequently marked with hemispherical impressions, and in many cases raised up like a cord (Plate LX. fig. 8, and Plate LXI. figs. 6 to 8, and 10 to 14). We must not forget to

mention that the Mariere men had jugs, with spouts nearly like ours. In the clay itself is sometimes found (as in the Casola vessels) powdered rhomboidal calcareous spar, the tarso of the potters of that town.

Several implements of wood have lately been obtained from Castione; they are drawn Plate LXII. figs. 5 and 6, and Plate LXIV. figs. 1 to 11, and consist of haftings of awls, paalstab-shafts, shovels, pegs, and spatulæ; there is also a ring both in shape and size similar to the common supports of the earthen vessels; many other wooden things were found, amongst which are the remains of four baskets. The stone implements are not numerous; one single chisel has been found of touchstone or the hard jasper of the lapidaries, a flint saw, several mealing stones, some of which were of talcose slate containing garnets, a kind of rock not found in the district of the Via Æmilia but in the Western Alps; and, lastly, some worked stones of porphyry (Plate LIX. fig. 8); syenite and limestone, in form resembling the weights for the nets or for the loom, or corn-crushers, or the objects known under the name of slingstones. The bronze objects found in the terramara consist of pins, awls, or pointed instruments, styles, chisels, hoops, sickles (Plate LXII. figs. 3 to 6, 10, 16, and 17). Many interesting things are dug up of bone and horn, such as horns cut into pieces, the ends of horn polished, and in some cases with holes bored through, spatulæ, and small chisels, probably for shaping the earthenware vessels and engraving the ornaments upon them, pegs like those of a violin, most of them with a hole through the head, curved pins, like saddlers' pins, made out of split horns, handles of awls, daggers, and other tools, ornamented with engraved designs; and, lastly, some little wheels with 4, 6, or 8 spokes, in some cases with a second hoop between the nave and the rim (Plate LXII. figs. 7, 8, 9, 11, 12, 13, 15, 26, 27, and Plate LXIII. figs. 11, 13, 14). Lastly, several rough instruments have lately been found at Castione, such as the fibulæ of the swine, and the metatarsal bones of the stag, sharpened at the upper end and bored through at the lower extremity, the horns and ulnæ of stags made sharp, small double-pointed tools and hammers made of stag's horn.

Amongst the personal ornaments there are fossil shells from the pleiocene beds, washed down from the Apennines, which have been ground and perforated by the drill or swivel, and then ranged on a string; two neat combs of bone (Plate LXIII. figs. 6 and 15), and one of bronze (Fig. 7). Hairpins and other bronze

ornaments (Plate LXII. figs. 1, 2, 21 to 23). The objects drawn Plate LXII. figs. 14 and 18 have a great resemblance to the half-moon ornaments found in the lake of Bienne and Neuchâtel.

Very few bone weapons have hitherto been found: in fact, the greater part are coarsely-worked arrow and javelin-heads (Plate LXII. figs. 20, 24, 25, 28 to 30). One of the latter, which was four-cornered, was found still sticking in a part of the shaft (Fig. 29), and in another the asphalt cement still adhered to the lower part. Flint arrow-heads are very rare in the Mariere; only one stone celt has hitherto been dug up in them, and it bears traces of having been rolled. In the museums of the Æmilian district there are a good many, but none of them have any note attached giving the localities where they came from, or they are only mentioned as 'found in the Apennines;' it seems, therefore, probable that in this country the antiquities of the stone age are to be sought for in these hills. The country people call the stone celts by the name of 'thunderbolts' (*pietre del fulmine*).

The majority of the weapons are made of bronze, and, at any rate, a part of them, as, for instance, the dagger blades and combs, have been cast on the spot, for the scoria and moulds have been dug up with them (Plate LXIII. figs. 8, 9, and 10). The blades, which are of very varied forms, are the most numerous amongst the weapons (Plate LXIII. figs. 1 to 5, and Plate LIX. fig. 4), after which come the paalstabs and the small hand hatchets of many different forms (Plate LIX. figs. 1, 2, 3, 5, and 6); not a single celt of the regular shape has yet been found. The arrow-heads are not abundant (Plate LXII. fig. 19): the lance-points are still more rare (Plate LXIII. fig. 12). A mould made of talcose slate for casting lance-heads of bronze has been discovered in a marl-pit in the district near Reggio. A kind of knife, like one found at Estavayer (Plate XLIX. fig. 3), and an arrow-head are the only iron weapons which have been dug up in the Mariere, and it is not quite certain whether they actually belong to the same period as the other weapons, or have been mixed with them by accident in later times; this, however, seems hardly likely, as a large quantity of iron scoria or dross has been found in the same place.

Spindle-whorls and rings of various sizes and shapes are found in abundance in the Mariere. The largest, which is made of clay, is about six inches across and weighs nearly five pounds English. Some are like the fossil nummulites, others are spherical, nipple-shaped, or conical; most of them are plain, but

some are keeled or ornamented with engraved lines, either straight or curved. Nearly all of them are made of clay (Plate LXIV. figs. 12 to 16), a few of them are of soap-stone or stag's horn (Fig. 17), and single specimens have been found of limestone and of amber. The little spindle-whorls of limestone and stag's horn are smoothed or polished. One little clay spindle-whorl has the form of a six-rayed star (Fig. 18). A larger one of the same material is four-cornered, and in some of the same kind four engraved lines radiate crosswise from the central hole; the clay of which they were made, as in Switzerland, was very carelessly worked, and mixed up with all sorts of heterogeneous matter. Plate LIX. fig. 7 is the sketch of a kind of cylinder very much contracted in the middle, and with one edge perforated with three holes: its use is unknown to me.

Little disks and balls of clay (Plate LXIV. fig. 19) are also found in the Mariere. To the antiquities just described we may add a beautiful mould for casting a comb, lately discovered; a drawing of it is given Plate LIX. fig 9.

II. ORGANIC REMAINS.

The organic remains which hitherto have remained entirely unnoticed are of no less importance to science than the productions of human industry.

Of late years human skeletons have been dug up out of the Mariere, but, unfortunately, they were broken to pieces and dispersed: a radius is all that can now be found. It belonged to a skeleton which was discovered above the lake dwelling of Castione, buried with others in a horizontal position. This bone weighs nearly two English ounces, and is 9½ inches in length. The man to whom it belonged must consequently have been approximately 5 feet 6 inches high.

The majority of the mammalian bones are imperfect, with the exception of the bones of the extremities. There is hardly a bone of the cranium which is perfect, and very few of them can be found and recognised in the terramara. No whole skull has yet been discovered. Hardly any of the bones of the face also are uninjured, and very few of them are found, with the exception of the jaw-bones. The horizontal portion of the under jaw is almost always separated from the upright part, and broken off at the end of the alveolar portion. Only dogs' jaws have as yet been found whole. The cylindrical bones, such as

the humerus, the femur, and the tibia, are almost always broken in two, either across or lengthwise. A large number found in the marl-pit of Ponte Nuovo were, with a single exception, broken off at one end. Of some animals, as, for instance, the stag, very few bones have been found, as they could be used for handicraft purposes. It may be further remarked, that bones of all kinds lay mixed confusedly together, just as they might have been thrown after having been used for food or industrial purposes.

The bones of domestic animals, especially of the cow and the pig, undoubtedly are found in greater numbers than those of wild animals; it was only now and then that one of the latter sort fell into the hands of the settlers of the Mariere, as, for instance, the bear.

It appears that they possessed only one race of dogs, which probably was nearly the same as the marsh dog, if, indeed, it was not identical, differing only in being somewhat smaller. Nearly all the lower jaws which have been found have the same characters both as to teeth and bone. Not a single bone of the cranium has yet been found, and very few bones of the extremities, only a humerus and ulna; a shoulder-bone and a pelvis were also dug up.

The remains of two races of pigs are found in the Mariere—the domestic and the marsh swine; those of the first are not abundant, while at the present day it is the only breed kept in the country.

Very few remains of horses are found in the terramara, and apparently not at all in the lowest beds. They belong to two breeds—one smaller, more finely formed, better bred, and more ancient; and the other larger, heavier, and more recent. Bones of the ass are only found in the upper beds, and even then there is some doubt about them.

As already mentioned, most of the bones belong to the cow, of which those of the smaller breed, the marsh cow, and a still smaller variety, are the most common; and those of the larger or the common ox are more rare. Many bones of the face, belonging to the first, were found, and pieces of epiphysis of the others. The marsh cow has now disappeared from the theatre of the Mariere.

The goats of the terramara appear to have been somewhat smaller than those of the present day.

Only a few sheeps' bones were found, and they nearly all belong to the marsh sheep. Occasionally, perhaps, in the later settlements, the remains of a larger breed are met with.

All the bones of wild animals found belonged to five species only: this number will doubtless be increased in time, when more attention is paid to the remains of smaller animals.

Most of the antlers are those of the stag, but of a large variety, which exceeds that of the present day in size, and stands between it and the cervus megaceros; both the main branch and the offshoots are flattened at the top of the horn. The bones of the cranium appear in this species to have been broken open as if by other animals. The inhabitants of the Swiss lake dwellings, on the other hand, opened skulls of this kind by separating the squamous portions of the temporal bones.

The roebuck of the terramara does not seem to differ at all from that of the present day.

But few remains of the wild boar have as yet been dug up. The finest and best preserved specimens were found lately in the peat, underlying the terramara, at Castione. There are two under-jaws, almost perfect; one of them is that of a very old male animal, with the alveolus of the first premolar obliterated: it is a little larger than that drawn by Prof. Rütimeyer. Both of these under-jaws have a wide round hole in the middle of the upright ramus, and one of them has still a piece of wood sticking in it, probably the remains of the staff or the lance-shaft on which they had been hung as trophies. Further excavations will show whether the wild boar was a common animal in the time of the Mariere. Probably the marshy nature of the land may have been favourable to the wild boars, by keeping the bears at a distance, the remains of which are only here and there met with in the terramara, as they probably were only to be obtained by the inhabitants when hunting in the Apennines. Only one tusk of this predacious animal has been found: a fact which corroborates this opinion. The imperfect skeleton of a water-mouse was lately found at Castione; and this closes the list of mammalia.

The terramara, up to the present time, has yielded but few birds' bones; only some of the hen and of the common, or perhaps the wild duck. No trace was found either of amphibious animals or fishes.

The remains of molluscous animals abound in every locality; they are simply of species which at the present day live in water or on land, in the plains of the Po or on the hills of the Apennines; such as Cyclas sp. (?), Unio pictorum, Alasmodonta compressa, Anodonta sp. (?), Paludina vivipara and achatina, Limnæus peregor, minutus, stagnalis, which are shells living in fresh

water. Zonites Draparnaudi, Helix carthusianella, fruticum, hispida, candidula, Ammonis, and nemoralis, which live on the plain. Helix etrusca and lucorum, Cyclostoma elegans, shells living at the foot of the hills. Zonites leopoldianus and Helix obvoluta, which are shells living on the mountains. The shells of the hills were evidently washed down by the streams and deposited with the freshwater shells of the Po at the periodical inundation of this river, or possibly they were brought here in mud by the settlers of the Mariere.

The remains of plants from the terramara have been but little studied: more attention has been given to those found in the peat earth lying below it at Castione. The remains of food or stores of provisions are frequently met with, such as corn (*Triticum turgidum*), hazel-nuts, pears and apples, sloes, cornel cherries, and pestachio-nuts (*Staphylea pinnata*), and also different kinds of acorns. All these were chiefly found in a burnt condition. Beans are said to have been found also in this state in abundance like corn. There is plenty of linseed to be met with. Cord of two strands, and also nets and woven cloth, all made of flax, were found here. The piles for the lake dwellings were hewn out of the trunks of oak, elm, and chestnut trees. Many seeds and fruits, and some kinds of moss and fungi (*Polyporus* and *Dœdalea*) are yet undetermined.

The marsh pig, the marsh cow, and the marsh sheep, amongst the domesticated animals, and the red deer, the roebuck, and the wild boar, amongst the wild animals, have disappeared from the stage of the terramara; in fact, the latter did so in the later historic period. This is the chief difference which as yet we have been able to observe between the fauna of the Mariere and that of the present day.

III. ORIGIN OF THE TERRAMARA OR MARIERA BEDS.

Different opinions have been expressed by several authors as to the origin of these beds: amongst them are Venturi, Cavedoni, Ricci, Ghiozzi, and Mariotti, although none of them have paid any particular attention to these deposits. Gastaldi was the first who published a special treatise upon them,* in which

* Cenni su alcune armi di pietra e di bronzo trovate nell' Imolese, nella marniere del Modenese e del Parmigiano, &c. (Atti della Società Italiana di Scienze Naturali in Milano, 1861.)

there is a notice of these different opinions. The conclusion arrived at by the authors of this report, guided simply by facts, such as the composition of the beds, the objects found in them, and the nature of the localities, is that this deposit is the accumulation of various kinds of refuse either of the kitchen or of manufacture, or possibly of sacrificial rites left by several settlements of the pre-Roman inhabitants of Upper Italy; these remains are proofs of various settlements which continued for a greater or less period of time. The nation was partly nomadic, such as shepherds and hunters, and partly stationary, such as fishermen and agriculturists. Many of these accumulations still remain on the very spot where they had been deposited; others have, in later times, been worn away and undermined by the rain, by streams, or by the Po, or possibly have been washed away still further. Those first mentioned are distinguished by their containing in their original state horizontal beds of ashes and charcoal with a slight curve, as well as by the remains of lake dwellings, and fragments of pottery, with the fractured edges sharply defined, which are found in them. The earth is clearer, more chalky, lighter, contains more nitrogen, and affords a manure of the first quality. The terramara which has been washed down contains no particular trace of ashes, the charcoal is not in beds but dispersed, and is often entirely wanting; the objects found in it are worn or rolled, the earth is darker, more argillaceous, and contains less nitrogen, so that a good deal of it cannot be used for manure, as it does not pay the expense of excavating and carriage.

The accumulated terramara beds chiefly appear as slight elevations gently rising in the plain from the Apennines to the Po; but only in the provinces of Parma and Modena; no similar beds have yet been found elsewhere. In later times, the Romans, the Longobardi, and other inhabitants of the district, making use of these localities by preference, built villas and farms, castles and monasteries on these rises, and thus objects are frequently dug up in the Mariere (though in the original beds only towards the surface) belonging to these later inhabitants; such remains, therefore, are totally distinct from the actual and characteristic component parts of the deposit, and are of no account in the investigation of the terramara.

The weapons and tools found in these beds, as originally accumulated, nearly all belong to the bronze age. Stone celts, with other weapons and tools, are found, though not plentifully, in the

Apennines;* it appears, therefore, probable that the hills were inhabited before the marshy plain, even in the stone age, but that the plain itself was first made habitable in the bronze period.

In spite of some trifling differences, all the weapons, the tools, the lake dwellings, and even the breeds of domestic animals indicate a relationship between the inhabitants of the Mariere and the lake dwellings of upper Italy with the settlers of the lake dwellings of Switzerland and the Tyrol, especially of the bronze age. Implements have also been found, such as mealstones of talcose slate, with garnets, a kind of rock which is not found in the Apennines, its nearest locality being in the Alps. From these facts we might infer that the inhabitants of the Mariere pressed forward from the Alps into the plain of the Po in the bronze period, or at the very end of the stone age, bringing with them these implements, which, after having become unserviceable, were exchanged for others of the kinds of rock found in the Apennines.

Whether the settlers of the Mariere (as the authors of this report conclude with some reserve) were Celts, in fact Gauls, or more especially Boii, must be left to be decided by further more extensive and careful excavations, and by a more complete examination of these singular deposits.

It may be remarked in conclusion, that amongst the objects drawn, many are precisely similar to specimens in the collection of Colonel Schwab from the lakes of Bienne and Neuchâtel.

EARLY ANTIQUITIES FOUND IN ITALY, ETC., ILLUSTRATIVE OF THE IMPLEMENTS AND WEAPONS FROM THE LAKE DWELLINGS.

As it is only by careful comparison that we can at all hope to arrive at truth in antiquarian research, it may be advisable here, in as few words as possible, to collect some notices of early antiquities found in Italy, not in lake dwellings, but on the main land; they may illustrate the manner of life amongst some, at least, of the lake settlers, and may possibly indicate a relationship amongst tribes widely spread over a large extent of country.

Only a few instances can now be given—still they may be of interest. We will begin with the most easterly.

* Photographic drawings of these stone objects, by Professor Brigidini of Piacenza, are to accompany the account which will shortly be published on the excavation of the walls of the Ligurian city Umbria, by Messrs. Wolf and Pallastrelli.

The discovery made by M. Forel, the president of the 'Société d'Histoire de la Suisse romande,' is of great interest.* He has found in the caves of Mentone near Nice, stone implements, together with bones of different kinds of animals.

Large quantities of charcoal and ashes, with stone weapons and tools have been found at Brescia.

In the museum at Parma there is a series of earthenware vessels found in the neighbourhood, which are exactly like those of Mercurago and San Martino, both in execution and material.

At a place called Cumarola, a few miles from Modena, forty skeletons were discovered in 1856, simply buried in the earth three feet deep, and lying in two rows. Professor Cavedoni has given a complete and detailed report of this discovery in the Messaggiere di Modena.†

Each of these skeletons had on the right side, turned upwards, a socketed lance-head of copper, probably mixed with a little tin, and on the left a flint arrow-head. Besides these, some had on the right side a wedge-shaped lance-point, others a similar weapon of very hard serpentine, and others, again, had above the head a perforated stone celt, likewise of serpentine. One of these skeletons was distinguished from the rest by having on the right side a large well-worked lance, and above the head a cylinder (tubo) of bronze.‡ Some skeletons had previously been found in the same place in 1773; the implements found with them are preserved in the museum of the Royal University: one of them is of dark green serpentine, and has the form of a half-moon, and on the concave side a flat appendage that might be put into the cleft end of the shaft (Pl. LXV. Fig. 3). Figs. 5 and 6 are also of serpentine; Figs. 4, 7, 8, 9, are flint arrow-heads; Fig. 10 is of clay; and Figs. 11, 12, 13, and 14 are bronze.

Count Gozzadini has added most materially to our knowledge of the civilisation of the bronze age in Italy by his report on the Etruscan tombs discovered on his estate of Villanova, near Bologna.§ It is evident that these graves belong to a later

* Forel, 'Notice sur les Instrumens en Silex et les Ossemens trouvés dans les Cavernes de Menton.'

† Ragguaglio archeologico intorno allo scoprimento di un antico poliandrio o sia tumolo sepolcrale di circa xl guerrieri colle loro armi. (Messaggiere di Modena, 24 Dicembre, 1856, no. 1486.)

‡ This object is of bronze and not of iron, as was believed at first.

§ Di un sepolcreto etrusco scoperto presso Bologna, descrizione del conte Giovanni Gozzadini. Bologna, 1855. Also, Intorno ad altre settantuna tombe del sepolcreto etrusco scoperto presso a Bologna e per far seguito alla descrizione già pubblicata nei cenni del conte Giovanni Gozzadini. Bologna, 1856.

age than the burials of the bodies at Cumarola, and they are also later than the lake dwellings of Mercurago; and yet the objects of these three localities, as well as of those previously mentioned, decidedly seem connected in many respects. If we carefully examine the beautiful plates given in Count Gozzadini's report, and compare the objects found at Villanova with those of the Swiss lake dwellings, and with those of Mercurago, and also with the antiquities of Sesto Calende drawn Plate LXV. figs. 15, 16, 17, 18, 19, and 20, we may observe a striking similarity in the forms of the objects, but more especially in their mode of ornamentation by lines and dots.

A large number of weapons of the stone age were found by Mr. J. Cerchiari, on a spur of the Apennines, near Imola, in the parish of Goccianello (Figs. 21, 22, 23, 24, and 25). With the single exception of one specimen in bone, they consist entirely of objects made out of pebbles. Dr. Scarabelli, a well-known geologist, has described them in the 'Annali delle Scienze Naturali di Bologna,' in 1850. There are in all thirty heads of lances and arrows, and two stone celts. Of the lance and arrow-heads some are only just shaped out of the rough material, while others, on the contrary, are neatly finished. The facts that one of these lance-points was found near a heap of flint fragments, and that the greater part of these weapons consist of the flint of the district, lead to the conclusion that they were manufactured on the spot. Some time afterwards other things were found on the same spot, such as perforated clay balls, little millstones of talcose slate with garnets, such as that found in the vale of Aosta, and an extraordinarily fine perforated celt of diorite, and also three other beautifully-worked celts of very hard stone.

Arrow-heads, axes, knives, &c., made out of volcanic rock, have been found, together with bones of the stag and the swine, by Baron Anca, in some of the Sicilian caves,* and stone weapons, especially arrow-heads, have been found at Ancona. The country people pick them up and wear them as charms against lightning. The same belief, according to Mr. Nicolucci, prevails in the neighbourhood of Naples.

All these reports of stone implements having been found in different parts of Italy, the south of France, and even Greece, satisfactorily prove that the south of Europe has passed through its stone age in the same manner as the north of Europe, but probably at a much earlier period.

* Bulletin de la Société Géologique de France, 1860.

A LA TÈNE,* NEAR MARIN (Lake of Neuchâtel).

This station was known and mentioned in my first report on the lake dwellings to the Society of Antiquaries at Zürich, in 1858. Colonel Schwab, who kindly communicated the information, had at that time found it a rich locality, and had obtained a number of iron implements, such as swords with their sheaths, spear-heads, scythes, hatchets, knives, shears, rings, clothes-pins, &c. Since then, thanks to the labours of Colonel Schwab and Professor Desor, a large number of objects have been found, which are of the highest interest to the antiquary, and this station, therefore, deserves to be carefully studied.

The lake dwelling of Marin lies in a small bay with a low shore at the northern end of the lake of Neuchâtel, not far from the place where the river Thièle or Zihl carries off the surplus waters of this lake through a moory country to the lake of Bienne. From the observations of Colonel Schwab, the area with piles is from 1,000 to 1,200 feet long, and about 250 feet wide; the ground to a depth of some feet consists of a bed of peat mixed with lake mud; the thickness of this bed is not known, but it extends to the shore, and spreads over the surface of what is called the gross moos or great moor of Epagnier. On this bed of peat there is a muddy layer consisting of loam and sand, and from this the rotten piles of the ancient settlement are seen to project, but only a few inches above the bottom; sometimes they stand singly, sometimes in groups of three or four, or even of seven or eight together. The place where first Colonel Schwab, and afterwards Professor Desor, made excavations, is a very low hillock, made artificially with broken stones, called Ténevière, beginning about 60 feet from the shore, but stretching probably 150 feet into the lake; upon this the water is only 2 feet deep. On this 'steinberg,' just at the place where so many weapons were found, there lay on the lake bottom, when Colonel Schwab first directed his attention to the spot, three unworked beams of fir-wood from 15 to 20 feet long, very nearly parallel with each other, only a few feet apart, and resting upon upright

* The terms Tène (shallow) and Ténevière (submerged hillock) are provincialisms of the fishermen in the lake of Neuchâtel, and Professor Desor in his late work 'Les Palafittes,' derives them from the Latin '*tenuis*.'

piles; a row of triangular holes was cut in the middle of these beams, evidently to receive the tenons of the upright piles which formed the walls of some erection.

Fig. 11.

There was no trace of fire either on this wood-work or on the piles; and, in fact, at this station neither charcoal nor charred wood are to be found; so that this is to be ranked amongst those settlements which were not destroyed by fire. With respect to the piles, it may be noted that on the whole they are very numerous, from eight to twelve feet long, very much decayed, and they consist almost exclusively of the softer kinds of wood.

I must also remark that the specimens from Marin, now about to be described, were all taken from the Steinberg just mentioned; in fact from a portion of the bed of the lake about 50 feet long by 30 feet broad, consequently an area of 1,500 square feet.

The relic-bed in the remaining part of the lake dwelling has not been examined, partly on account of the greater depth of water and partly on account of the very soft nature of the bottom. No antiquities are found on the surface, as is the case in many other stations; they are not met with till the bottom has been trenched one or two feet deep.

Stone Implements.—Amongst these the only things to be mentioned are a number of flint flakes which lie scattered over the whole lake dwelling, and have no definite shape; also a dozen balls from six to eight-tenths of an inch in diameter, ground away about a quarter on one side; some of them are of white and others of black limestone, and they evidently belong to a kind of game. The spherical form is so perfect that they must have been made by some mechanical arrangement such as is used in manufacturing playing marbles. (Plate LXXII. Fig. 20.)

Bronze Objects.—Very few implements, comparatively speaking, were met with of this material. When the beam before mentioned was brought up, two or three bronze cauldrons were found, which had movable iron rings at the rim to serve for handles (Plate LXXXI. fig. 9). Since then two hair or clothes pins and an earring have come to light. The other bronze implements from Marin are a small hatchet with an oval helve hole (Plate LXXX. fig. 1), two large pieces of neatly

worked plate which had been fastened as ornaments to thin boards of wood or some other material, probably shields. (Plate LXXXI. figs. 4, 5, 8, and 10.) A small wire wound into a spiral on which is fixed a bead of blue glass. (Plate LXXX. fig. 19.) A lozenge-shaped fibula (Fig. 9). Rings and other implements the use of which is unknown to me (Figs. 17 and 20; Plate LXXXI. fig. 7); also a pair of small pliers or hair-removers, like some of the same implements made of iron. (Plate LXXX. figs. 2 and 3.) Clothes-pins and sewing-needles. (Plate LXXII. fig. 28.) A ring with a handle or shank, very much worn and containing very little tin (Plate LXXXI. fig. 11); this implement is 3 inches long. A massive ring 3 inches in diameter externally, and $1\frac{3}{4}$ inch internally, the section of which is circular; a round plate $3\frac{1}{2}$ inches in diameter of the thickness of drawing paper, and with a small hole in the middle. Plate LXXX. fig. 27, is a hollow ring of bronze. The ring with peculiar ridges round it (Fig. 26) is not from Marin, but by some chance has been drawn in this plate: it is from Montellier.

Objects of Clay.—In general, the existence of a lake dwelling is indicated by the occurrence of fragments of pottery and other objects of similar material, in the same manner as the sites of Roman buildings are shown by bits of roofing tile; but objects of earthenware are rare at Marin; in fact, they consist chiefly of Roman pottery, such as a fragment of 'terra sigillata,' on which is represented a biga, and a dozen bits made of rather grey clay; an earthenware vessel full of charcoal; a ring of very hardburnt clay, nearly 3 inches in diameter inside, and nearly 4 inches outside; an armlet which is rounded on the outside, and in front very neatly smoothed and polished, till it shines like some of the earthen vessels, so as to make it look exactly like the rings made of jet (Plate LXXII. fig. 21); and lastly some broken pieces of Roman roofing tiles.

Objects of Glass.—Pretty rings belonging to a necklace, white, blue and yellow in colour (Plates LXXII. figs. 7 and 8, and LXXXI. fig. 2); two small blue rings (Plate LXXX. fig. 18); a portion of an armlet of blue glass (Plate LXXII. fig. 6). Two rings exactly similar were found in 1842 at Horgen, near Zürich, in a grave (see vol. iii. of our Trans.). This grave, which contained a silver clasp, exactly of the form of those of Marin, a Gaulish 'Philipp's coin' of gold, &c., appears, judging from its contents, to belong to about the same age as the settlement of Marin. Rather a long bead of bluish glass (Plate

LXXII. fig. 9), and a round unperforated ball of glass, of a blue colour, with many yellow dots, which Col. Schwab informs me was the head of an iron hairpin. (Plate LXXII. fig. 12.)

Objects of Bone.—A fragment of a four-sided little rod, with engraved lines and dots, which at first sight looks like a measure, but evidently was not used as such (Plate LXXX. figs. 22 and 23). A long rectangular die; the four longer sides are marked respectively with 3, 4, 5 and 6 dots (Plate LXXII. fig. 4). A little ring about $\frac{3}{4}$ inch in diameter. An ornament of a cylindrical form (Fig. 10). The incisor of some animal with the part between the crown and the fang cut away, so as to be used for an ornament or amulet (Fig. 11).

Manufactures of Flax.—A piece of thick cloth platted out of strips of flax, exactly of the same description as was found at Robenhausen (Plate LXX. fig. 23). (See Plate LXXXIII. fig. 3). Col. Schwab thinks that this mat was not made of flax, but of bast.

Remains of Feasts.—These consist of some bones of the horse and the ox; also of hazel-nuts, burnt apples, corn, and grains of the wild mustard.

Human Remains.—A whole basketful, probably from eight individuals. Only one skull was found here, which is now in the museum of Professor Desor, and is drawn in his 'Palafittes,' page 102.

Iron Implements.—The number of specimens of this metal is surprisingly great, not only in proportion to the objects just described, but also considering the small size of the area which has been examined. It is by no means without cause that the lake dwelling of Marin has been called the settlement of the iron age. These specimens consist of weapons, of agricultural and domestic implements, and of ornaments, and they exhibit to our view, made of iron, whatever in the older lake dwellings was made either of stone, or bone, or bronze.

Several of the iron implements found by Col. Schwab at Marin, previous to 1858, are drawn on Plate LXXI., and even at that time it will be seen that the collection was of much interest. These various objects, together with the large number lately found and drawn in the other plates of specimens from this station, will now be described under their proper heads.

I. The swords (spathæ) are naturally of the greatest interest: they are drawn Plate LXXI. figs. 1 to 5; Plate LXXII. figs. 22 and 23; and Plates LXXIII., LXXIV., LXXV., and LXXVI.

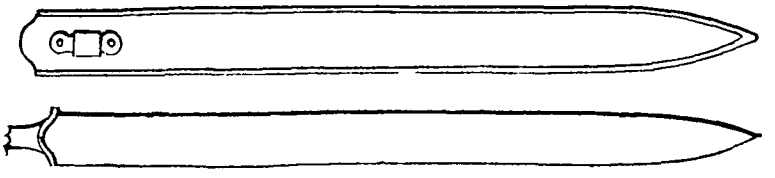
When, in the year 1858, we first published the swords which Colonel Schwab had then found, we remarked in the report made to the Antiquarian Association of Zürich, that they were of very great interest, not only on account of the excellence of their workmanship but also from the uncertainty as to their age and origin, which doubt has been carried in some antiquarian works to such a degree that they have been considered as Celto-Helvetic, as Roman and as Alemannic work.

In the first place, we may note the topographical distribution of similar kinds of swords, the distinctive characters of which are so well marked according to Professor Lindenschmit ('Alterthümer unserer heidnischen Vorzeit,' part i., Plate V. with drawings of *Roman* swords). One specimen was found at Ingelheim, the iron sheath of which had the Roman letters C. S. stamped upon it; and a second was found at the foot of the Swabian Alps; a third was found with an iron lance-head and with an iron ring, smooth on one side and notched on the other, in the year 1843, in the forest of Basadingen (Thurgau), on the removal of a natural sand-hill ten feet high (see 'Wächter,' May 9, 1843), and is preserved in the Antiquarian Museum at Zürich. More than a hundred specimens of this kind of sword were dug up in the years 1849-51 at Tiefenau, near Berne, together with other iron implements, such as daggers, lance-heads, hatchets, pieces of helmets, coats of mail (even ringed armour), greaves, horse trappings and ornaments, and all kinds of things belonging to war chariots—chiefly of iron, more rarely of bronze; besides which there were implements and ornaments both of bronze and iron (fibulæ), and also of glass, such as rings and beads, with a good deal of coarse pottery, and bones of horses. This 'find' was first described by Mr. Albert Jahn in his antiquarian and topographical description of the Canton of Berne, 1850, page 500, and afterwards described and drawn by Mr. G. Von Bonstetten, in his 'Notice sur les Armes et Chariots de Guerre, découverts à Tiefanau, près de Berne, en 1851;' and again noticed by the first-named gentleman in the 'Jahrbücher des Vereins von Alterthumsfreunden im Rheinlande' for 1854, page 135. Mr. Jahn refers the whole of these objects, some of which are preserved in the museum at Berne, to the old Helvetian population; on the other hand, Mr. Von Bonstetten assigns them to the German races who invaded Helvetia in the fourth century.

Lately, however, a treatise has appeared in the 'Revue Archéologique,' by M. Verchère de Reffye, under the direction of

the Emperor of the French, which throws great light upon these swords. It contains the result of explorations in the fortifications of Alise, the ancient Alesia, well-known in the works of Cæsar, and it gives photographic views of many of the arms found buried in the ditch, evidently the relics of the struggle which took place here between the Gauls and the Romans. The reader is referred for full information to this very interesting work, but the following woodcuts of swords found there, which have been copied from it, will give some idea of the similarity if not identity of the swords found at Marin and those lately discovered at Alise :—

Fig. 12.



The swords represented in the plates before referred to are chiefly in the collection of Colonel Schwab, of Bienne. One of the most remarkable, which will be hereafter referred to (Plate LXXVI. fig. 6), is in the collection of Professor Desor, of Neuchâtel.

The length varies from 2 feet 9 inches to 3 feet 6 inches. The spike for the hilt is rather broad at the bottom, on the average $5\frac{1}{3}$ inches long, terminating in a round or flat knob. Colonel Schwab informs me that in probably every case the swords of Marin had wooden hilts; in fact, in some specimens he found undoubted remains of the wood itself. The blade immediately under the handle varies in breadth from $1\frac{3}{4}$ inch to rather more than $2\frac{1}{2}$ inches, and narrows very gradually towards the end with tolerably straight edges, terminating in a point formed of two curves united; it is sharp on both sides, flat, and about a line and a half thick. No guard is found on any of the swords, but instead of it there is a bell-shaped strip of raised iron which forms the junction between the spike and the blade. The sheath is exactly of the same form as the blade, and consists of two pieces of iron plate, one of which is about half a line wider than the other, round which it is folded so as to form an edge or raised border. This flange or border does not extend to the lower part of the sheath, where the edges of the plates are kept together by two narrow cross-plates or strips of iron, which unite at the top of this portion of the sheath in an ornamental cross-

band. This piece of iron is soldered on one side and turns round the other in a kind of clasp or cramp, also ornamented (Plate LXXIII. fig. 1). In order to give greater firmness to the lower part of the sheath, the strips or plates on each side of the point swelled out slightly, and were sometimes ornamented, and the end was rather thicker. Possibly this lowest part of the sheath may have been a separate piece of iron, and the swollen appearance may have arisen from the two strips overlapping each other and being soldered together. The side next to the wearer is smooth at the lower part, but between the opening and the sword-belt loop, which was rivetted on with two nails, or sometimes on the loop itself another ornamented cross-band is placed as a kind of cramp. On the opposite side of the sheath the corresponding part has an engraved or raised line ornament.

The ornaments upon the sheath are very varied, as may be seen by the drawings. Sometimes they are covered with scattered impressed rings (Plate LXXV. fig. 10); sometimes with raised dots like shagreen (Fig. 9); or with little raised rings touching each other (Fig. 5); or with rows of small rings joined together as pairs by short straight lines running parallel with the sides of the sheath (Plate LXXIV. fig. 3); or with lines crossing each other like trellis-work (Plate LXXI. fig. 3); or wavy lines closely interlaced, somewhat of the pattern of the Damascene work (Plate LXXV. fig. 1). No trace, however, of the actual Damascene work, or the ornamentation by inlaying strips of gold and silver, which is found in Roman and more especially in Frankish ornaments, has hitherto been noticed either at Marin or any similar locality.

By far the most remarkable ornament on a sheath is that drawn Plate LXXVI. fig. 6. It is in the collection of Professor Desor. On a dotted ground three fantastic animals like roes are represented running, and all their extremities, horns, mouth, tail, and feet, terminate in sprigs of plants or flourishes. Similar representations have been published amongst the figures on northern antiquities, especially in Irish and Anglo-Saxon miniatures. This design is particularly interesting, as the animals most strikingly resemble those on Gaulish coins (Plate LXXXI. figs. 18 and 20 to 24).

With respect to the mode by which the ornamentation was effected, that on Plate LXXV. fig. 1, and on Fig. 5, according to the unanimous opinion of many 'experts,' has been done by etching and with the hand alone; while the crossing lines of

Plate LXXI. fig. 3, have undoubtedly been impressed. The mode by which the shagreen ornament was made is uncertain, and it is also very difficult to say whether the line ornaments at the very top of the sheath were the work of the chisel or of an acid like vinegar or lemon juice, &c. It is, however, evident, that the ornamentation on the sheath (Plate LXXV. fig. 4) was made by the use of a fine chisel, and on that of Plate LXXIV. fig. 3, by the strokes of a punch.

The general appearance of these swords would lead us to the conclusion that they were not the work of any isolated military smith, but may be considered as the production of larger workshops and manufactories, where there was a division of labour and every practical appliance; and this view is fully confirmed by the 'maker's marks' found on several of the blades.

Thirteen marks of this kind are already known, of which the two left-hand figures and the upper right one of Plate LXXVI. fig. 11, and also the upper one to the left of Fig. 12, are somewhat similar, and probably indicate the same company; Fig. 13 is rather similar. With the exception of the rude figure of a boar, as shown Fig. 14, three lately found, Plate XCVI. figs. 4, 5, 6, and the trefoil, all the marks bear some resemblance to the form of the half-moon, which, as well as the boar, appears on many Gallic coins. If the remaining marks are found on Gallic coins, the supposition would probably be correct that different districts were indicated by these marks. No trace of a letter has yet been discovered. Amongst the swords of this description the specimen published by Professor Lindenschmit (Alterth. u. heidn. Vorzeit, Heft i. Taf. 5), on which the letters C.S.I. appear, in this respect remains unique.*

About fifty swords have been found at Marin up to the present time, some with and some without sheaths. The latter are all made of iron, with one single exception, which consisted of thin bronze plate. They are, on the whole, masterpieces of the smith's art, and in making them the hammer was chiefly used—not the file—and the polish of the smooth, shining portions was obtained by the use of scraping and grinding tools. Not one of these swords, either in length, breadth, or weight, is exactly like any other; and the ornamentation is remarkably different in every specimen. Most of them are in good preservation, but still some of them are bent and full of notches at the edge (Plate LXXIV. fig. 1).

* We hope that Professor Lindenschmit will not take it ill if we do not consider these letters as Roman. They stand obliquely on the sheath, one above the other.

We are indebted to M. de Reffye, in the work already referred to, for the following particulars as to the mode of manufacture and the materials employed for making the swords found at Alise, and we may with safety conclude that the analogous arms found in Switzerland were made in the same manner. 'We may remark,' he says, 'that the cutting edges of these swords are not of the same iron as the body of the blade. The workman, after having forged this part out of very tough iron (très-nerveux, very fibrous iron), drawn out lengthwise, welded on each side little strips of soft iron to form the cutting edges; this iron was afterwards beaten to an edge by the hammer. The soldier could thus after the fight repair with the hammer the damage done to his sword, just as a reaper sharpens his scythe when it is notched. The sheaths of these swords are of iron; they appear all to have been made on the same plan.'

Many of the swords found at Marin had pieces of charcoal attached to them which seems to show that they had not fallen into the lake by chance, when a vessel was lost, but had sunk into the water and mud when the lake dwellings were burnt.

There has always been very considerable difficulty in determining the age and origin of swords. The authorities used for this purpose have been the representations on Roman sculptures; the description of these weapons in Polybius, Livy, Vegetius, and others; the nature and peculiarities of the antiquities found with them; and, lastly, such histories of a country as give any account of the early population, and the native arms and equipments. But, with all these helps, it has always been a very difficult matter to decide with certainty whether a sword has belonged to a Roman or non-Roman warrior, or in fact to what age it belonged. Very different views have been expressed as to the swords preserved in various collections, just as the investigators' attention is drawn to the shortness, or the length of the blade, and to the bluntness or sharpness of its point.*

With reference to the present locality, the greatest light thrown upon them has been by the discovery of the swords found in the ditches of Alise before referred to, which evidently were of Gaulish origin and agree exactly in general form with those of Marin. The ornamentations of the Alesia swords have for the most part disappeared: those on the weapons from Marin are in very good preservation, and ought to be the safest grounds for deciding their origin. We must, however, remind

* Respecting the form of Roman swords see the 'Rheinländische Jahrbücher,' pt. xxv. p. 110.

the reader that these ornamentations do not show the least relation to the Celtic implements which have come to light and quite as little so to those of Roman origin. We cannot, however, help mentioning the peculiar ornamentation so very different from the Celtic element, which is to be seen on some bronze rings drawn in M. von Bonstetten's 'Recueil' (Plate VII. fig. 4), and in vol. ii. of the 'Bulletin de la Société pour la Conservation des Monuments Historiques d'Alsace' (Plate II. fig. 5).

II. Spear-heads (lanceæ) (Plate LXXI. figs. 11 to 16; Plate LXXII. figs. 1 and 2; Plate LXXVII. figs. 1 to 5; Plate LXXVIII. figs. 1 to 4 and 7 to 9; Plate LXXIX. figs. 1 to 7). If the swords appear to have been made after a normal form, thus differing essentially from other weapons of that kind, the lance and javelin-heads exhibit a great variety of shape which leads to the conviction that the makers did not follow any pattern, but worked simply according to their own fancy. As there is no actual difference between weapons used to thrust and those made to be thrown, we can only classify these weapons by the length of the socket and the breadth of the blade. In each of these divisions, however, there are many varieties in the form of the blade. Sometimes it diminishes like a willow leaf, or it terminates in a sharp needle-point; sometimes the form is like that of a flame, or approaches that of a laurel leaf. The length of the longest of these weapons is 18½ inches, that of the shortest 5½ inches. The breadth of the widest is 3½ inches, that of the narrowest about eight-tenths of an inch. Some have been made very weak, and others very strong. Again, some have a very considerable ridge in the middle, while others have none, and of those which have a ridge it is sometimes angular and sometimes half round. The weight also differs very considerably. In general, they are distinguished from Roman and mediæval weapons of this kind by being lighter. On the sockets of some of them there is a rivet hole which is wanting in others. No ornaments are to be seen on any of the spear or javelin-heads found at Marin, except the engraved or raised lines on the borders of the socket.

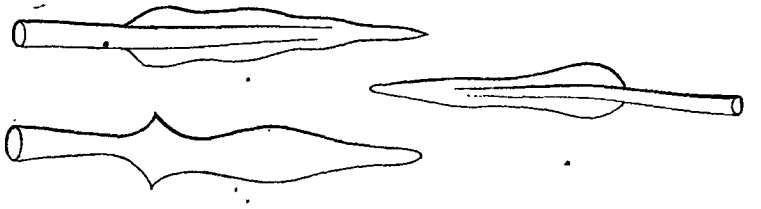
These implements are quite as remarkable as the swords for the ability displayed in their manufacture. The smith evidently understood how to bring his work to such perfection as to indicate a high grade of his art. The angular longitudinal ridge (nervure), which from the investigation of M. de Reffye is hollow, runs from its commencement at the socket, gradually diminishing to the point; and the two sides of the blade, the thickness of which diminishes at the edge to about

the fiftieth part of an inch, are so skilfully hammered out and made smooth, and polished by scraping tools and grinding stones, as to leave nothing further to be desired as far as the workmanship is concerned. It is not impossible, especially in the specimens with hollow ridges, that the two plates were welded together into a blade in the manner commonly used in the middle ages for making halberds. The socket, as shown by the seam, was made by bending round the plate of the blade and welding it. The use of such workmen's arrangements as the 'set-hammer' or intermediate hammer with a 'swage' or groove, and what is called the 'under-tool' or small anvil with a corresponding groove or 'swage' may be considered as certain. The action of a file has not been noticed on any of these weapons. M. de Reffye has shown that the material is steel.

Amongst the large number of these weapons those drawn Plate LXXII. fig. 1 and Plate LXXVII. figs. 3 and 4, are unquestionably the most remarkable,* as from their peculiar form they differ materially from similar weapons either of barbaric or classic antiquity. The blades, in fact, have portions cut out either on the outside or in the middle near the ridge, in the shape of the segment of a circle. At first sight, one might suppose that these had arisen from defective places caused by rust, or by the bending of thin plate which was put to such a trial and which the smith endeavoured to remedy by giving the instrument a regular form, but this supposition could have no foundation with respect to the parts cut out in the middle of the blade.† Similar excised portions, in the form of a circle and semicircle, are known even in the older bronze weapons of this nature (see the 'Horæ Ferales,' Plate VI. figs. 16 and 23),

Fig. 13.

Fig. 14.



* The annexed woodcut of three of the lances found at Alesia, copied from the work of M. de Reffye, will show how very similar they are in form to some of those found at Marin.—[Tr.]

† I am indebted to my friend, the Rev. C.W. King, for the annexed woodcut which represents, on an enlarged scale, the reverse of a coin of Constantine, minted at Treves, and

and are considered by Mr. Franks as the means of lightening the implement and saving the metal. There can be no doubt that the excised portions on the edge of the blade would make the weapon more dangerous, and increase the size of the wound, just as greater effect was ascribed to the flamboyant sword of the Middle Ages than to the straight sword. The specimen drawn Plate LXXII. fig. 1, plainly shows that some advantage was expected from such refinements in the form of the spear-head.

The specimen drawn Plate LXXII. fig. 2, is no less remarkable. It is in Colonel Schwab's collection, and is 9 inches long from end to end, of which the socket is 2 inches and the blade about 7. It is more than 3 inches broad and has an angular ridge which projects considerably. What distinguishes this specimen from others is the fact that the edges of the blade are indented at regular intervals, so that the side view, as shown in the plate, instead of being straight is sinuous. It will readily be seen that this arrangement was intended to tear the flesh and to increase the size of the wound both when it entered and when it was withdrawn.

This weapon is of peculiar interest, as in all probability it brings before us the kind of spear described by Diodorus in his account of the military equipment of the Gauls, v. 30. The following are his words:—'They use for weapons lances, which they call *λαγκίας*, which have appendages (points or heads) of iron an ell in length or still more, but in breadth somewhat narrower than two palms (hand breadths). For the *ξίφη* (the short Greek or Roman legionary swords) are not smaller than the 'saunia' used by other nations, but the 'saunia' (of the Gauls) have greater heads than the *ξίφη*. Of these some are forged straight, but the others have throughout a wavy indentation (*ἑλικοειδὴς ἀνάκλασις*) in order that when it strikes it may not only cut but also lacerate the flesh, and tear open the wound when it is withdrawn.'

The expression *ἑλικοειδὴς* is generally translated in German by the word spiral, and it is supposed that the head of the spear was twisted round on itself in a spiral form; but according to this view we should have a very useless instrument, in fact, it

now in my collection. Mr. King, in his unpublished treatise, from which he has allowed me to make extracts, says: 'It shows the Gallic Mars equipped with the peculiar national lance with its enormously dilated blade and lunar-shaped barbs, and a shield perfectly novel in construction. On several coins also of the same date, issued from Gallic mints, the cavalier on the reverse wields a lance, the blade of which is two feet in length —judging from the proportions of the rest of the design.'—[Tr.]

is one which never existed. In the French translation of Miot the words run thus: 'De ces armes les unes sont forgées droites, d'autres en zigzag avec l'extrémité recourbée en arrière.' In the original, however, there is nothing about the 'extrémité,' but, on the contrary, a curvature or indentation throughout. Moreover, a lance-head twisted in a zigzag and with the point bent back would be a still stranger form than what has just been alluded to. The expression *ἑλικοειδὴς ἀνάκλασις*, as it appears, is to be understood as 'with wavy indentations,' and in the passage referred to it means that the edge of the spear blade which usually is in a straight line, is bent alternately up and down so as to form a sinuous line.*

With respect to the use of these broad spear heads, it may be remarked in general that, on account of the shortness of the socket, the small thickness of the shaft, and the weakness of the blade, they must have formed very feeble weapons, and necessarily have bent when they came against a shield or a breast-plate on some powerful antagonist. They appear chiefly fitted for wounding unprotected parts of the body not for thrusting through; in fact, specimens are found which must have been used more for parade than actual fighting.

III. Ferrules or points for the feet of the lances.—About half-a-dozen specimens of the ferrules or points for the lower part of the shaft of the lances (*στύρακες*) have been found, which were as carefully made as the other part of the weapons just described; they are pyramidical points, having eight or ten sides, and vary in length from $4\frac{3}{4}$ to 7 inches. Two specimens of the simplest form are drawn Plate LXXX. figs. 15 and 16. In order to

* Diod. v. 30. *Προβάλλονται δὲ λόγχας, ἃς ἐκεῖνοι λαγκίας καλοῦσι, πηχυαῖα τῷ μήκει τοῦ σιδήρου, καὶ ἔτι μείζω τὰ ἐπιθήματα ἐχούσας· πλάτει δὲ βραχὺ λειπόντα διπαλαίστων. Τὰ μὲν γὰρ ξίφη τῶν παρ' ἑτέροις σαυνίων εἰσὶν οὐκ ἐλάττω, τὰ δὲ σαυνία τὰς ἀκμὰς ἔχει τῶν ξιφῶν μείζω. Τούτων δὲ τὰ μὲν ἐπ' εὐθείας κεχάλκευται, τὰ δὲ ἑλικοειδῆ δι' ὅλων ἀνάκλασιν ἔχει, πρὸς τὸ καὶ κατὰ πὴν πληγὴν μὴ μόνον τέμνειν ἀλλὰ καὶ θραύειν τὰς σαρκὰς, καὶ κατὰ τὴν ἀνακομιδὴν τοῦ δόρατος σπαράττειν τὸ τραῦμα.*—*Reiske's Version.*

The passage, however, is corrupted, as is rightly remarked by M. de Rougemont in Professor Desor's 'Habitations lacustres;' for, in the middle of the description of the lances, there is interpolated a comparison of the 'xiphos' with the 'saunion,' of which nothing else is said in this book. Whatever way these words may be turned, it is impossible to bring the sense into connection with the context, and the only way is to consider the sentence from *Τὰ μὲν γὰρ ξίφη* to *ξιφῶν μείζω* as an interpolation, and to refer *τούτων δὲ* to the word *ἐπιθήματα*.

[The author, with his usual candour, will I trust, forgive me for mentioning that his views as to the interpolation of this passage are not agreed to by more than one of the leading classical scholars in England; this, however, is not the place to enter into a discussion of this nature.—Tr.]

prevent the splitting of the shaft where the spike goes into it, there is a ring or cramp which fits close to the base of the point. Some of these ferrules and rings are a little ornamented.

No arrow-heads were found either at Marin or at Tiefenau, a locality which will shortly be referred to, from which it may be inferred that the people to whom these weapons belonged did not use the bow.*

IV. Shield plates (straps or handles). The shields found in England corresponding in the character of their ornamentation with the sword sheaths met with both there and here (at Marin and Tiefenau), have had rather a long rectangular form, sometimes rounded at the corners. This form of shield is also in fact, indicated by an implement made of iron plate found with the above-mentioned swords, not only at Marin but also in the graves.

These shield mountings are drawn Plates LXXIX. fig. 8, and LXXX. figs. 13 and 14. They consist of iron plates from 8¼ to 14 inches long, from 4 to 5 inches wide, and very thin, the middle part of which is hammered out into an arched form, and the edges are bent down on all the four sides. The two wings are broader at the end, and have the edges sometimes cut out ornamentally. They have been fastened to the shield by flat-headed nails or studs with the heads about an inch and a third in diameter. The shield, judging from the space between the head of the nail and where it was bent round, must have been from ½ an inch to $\frac{6}{10}$ths of an inch in thickness; some fibres rusted on to the plate show that it was made of wood.

Plate LXXX. figs. 10, 11, and 12. This implement consists of two four-cornered plates of iron joined together by a curved iron rod rivetted to the plates, and which seems intended for a handle. We have some doubt whether it was a shield holder.

Plate LXXXI. figs. 12, 13, 14, and 15. We cannot determine whether these two implements were intended for warlike or household purposes. They consist of iron rods rather more than ½ an inch thick, bent round into the segment of a circle, and having a spine at one end and a kind of cap or hood at the other. They seem to have been fastened by this cap into some other object, and the spike at the other end has been let into a hollow, or has had something fixed on to it. One of these implements (Figs. 12 and 15) is ornamented and uncommonly neatly

* Diodorus does not mention the bow as one of the weapons of the Gauls; on the contrary, Strabo says that it was used by some of the Belgæ.

worked. The other (Fig. 13) is more simple: the section is quadrangular and the outside of the curve is ornamented with longitudinal furrows. Probably these specimens are of a similar description to the bronze implements with a ring at one end found at Tiefenau and drawn by the Baron de Bonstetten in his 'Supplément au Recueil d'Antiquités Suisses.'

Plate LXXX. figs. 4 and 5 are appendages to some object smaller than those last described: they are all of one piece. Both are a little bent round, but a third specimen, exactly like the second, is quite flat. Fig. 6 is an implement possibly of the same kind, of a spatula shape.*

Amongst the implements evidently belonging to domestic economy may be mentioned the iron ladle (Plate LXXXI. fig. 1); the staple (Plate LXXX. fig. 7); the ring and staple (Fig. 8); the wire (Fig. 21); and probably also the rings (Figs. 24, 28, and 29); the iron hook (Fig. 25), and the ringed staple (Plate LXX. fig. 6).

Two three-pronged iron forks were found here: one of them is drawn Plate LXXI. fig. 18.

Plate LXXI. figs. 22, 23, and 24 are hatchets. Fig. 22 has the sides bent up so as to form flanges for the shaft like those of some bronze celts. Fig. 23 has these side flanges bent so far round as to meet and form a socket; thus these two specimens show very clearly the transition from shaft flanges to sockets. Fig. 24 does not differ from the Roman form.

Plate LXXII. fig. 18 is a kind of hatchet or gouge; it is more than 3 inches long, and the cutting edge is about $1\frac{1}{8}$ inch broad; it has a socket though the sides do not quite meet, so that it is somewhat like the bronze celts; the edge is not straight, but, like a gouge, is intentionally curved and in opposite direction to the sides of the socket. It had been fastened to a handle with a nail. Plate LXXI. fig. 21 is a tool like a spatula or gouge about 1 foot in length. Fig. 17 may have been a small dagger. Figs. 19 and 20 are hedging and pruning bills. Fig. 26 is a pair of shears. Fig. 27 is a currycomb: the raised part at the top is prolonged backwards into a handle. Fig. 8 is a steel for striking fire like one found in a grave at Holderbank in the Canton of Aargau. Figs. 9 and 10 are knives. Plate LXXII. fig. 3 is also a knife. Several other

* Compare the shield-handles drawn Plate 8, figs. 5 to 10, in the very interesting work by Engelhardt, on the Danish antiquities of the early iron age, which has just appeared while these pages were going through the press. The Danish handles are of wood, bronze, and silver, ornamented with gold.—[Tr.]

cutting instruments were found ground like knives: in some specimens, the end was bent round into a handle or terminated like this specimen in a ring; they evidently were carried or suspended from the person. In one of the holes in the handle, there was a small wire. They resemble the bronze knives from Nidau Steinberg drawn Plate XXXV. figs. 20, 23, and 24; and the implements found in Etruscan tombs and considered as razors (see Gozzadini, 'Sepolcri Etruschi').

Plate LXXII. fig. 27, scraping iron: a kind of knife 7 inches long and in the middle $\frac{8}{10}$ths of an inch broad, somewhat in the form of the segment of a circle; it is throughout rather more than $\frac{1}{10}$th of an inch thick, but is ground slopingly on the convex side: apparently it has been used less for cutting than for scraping, and probably had a handle at each end.* Fig. 14 is a hexagonal tool, called by workmen a 'rimer' or a 'taper drill,' for widening holes. Fig. 16 (and 19 side view) is a hook made of a strip of iron pointed at one end. Fig. 13 is a Roman key.

Several pins were found at Marin with round or triangular heads, rather flat, and with perforations of a corresponding form. A number of rings were met with, rather flat, from $\frac{1}{12}$th to $\frac{1}{4}$th of an inch thick, the diameter of which internally is from $\frac{6}{10}$ths to $\frac{8}{10}$ths of an inch, and externally from $1\frac{1}{2}$ to 2 inches. On one side they are rather convex, on the other rather concave, and thinner in the middle than at the edge. They appear to have been used as some kind of support.†

Plate LXXII. fig 5. Horse's snaffle-bit. It consists of two neatly-made portions joined together, so as to be movable; at the two ends there are large rings, also movable. The width of the bit between the large rings is $3\frac{1}{2}$ inches. The rings of this bit, in the places where they touch, have, by long use, been worn through to half the original thickness. Two specimens were found of this kind.

Plate LXXII. fig. 15. Linchpin. This implement is in the form of a saddler's knife, with a round rod attached to it; in the flat portion there is a rectangular hole. It may probably have been used for a cart-wheel.

Plate LXXI. fig. 25, is an anchor made of stone and iron. The centre portion is an eight-sided prism of stone, about 30lbs. in weight, into the lower part of which iron arms are fastened,

* Probably this implement was used like our modern 'hoopshavers.'—[Tr.]

† May they not have been what are now called 'washers' by coachmakers and others?—[Tr.]

bent, and of the shape of willow-leaves. Originally it had four of these arms or hooks. The upper hole was used for fastening the cable to it.*

Ornaments.—Amongst these the clothes-clasps, or fibulæ, are the most remarkable, which have been found in great numbers. Colonel Schwab's collection contains more than 100 specimens. They vary very much in size, without, however, exhibiting any striking variety of form. They all consist of a single piece of wire, which is twisted nearly into the shape of the figure 8. At the upper end of the fibula, or rather at the lower, for, when fastened to the clothes, the pin pointed upwards (see vol. xi. of our Transactions, Part iv. Plates I. and II.), this wire, in order to give elasticity to the fibula, is wound round into a spiral, and at the other end of the clasp the wire was beaten flat and bent half round, so as to form a kind of socket to receive one end of the wire which formed the pin or tongue. The other end of the wire, in order to give greater firmness to the whole, is, in the simplest form, attached to the main or middle portion by a kind of hook which runs round it, but in the specimens of a better description the two are fastened together by a ring at the point of contact. This portion is sometimes ornamented with incisions at the side, and sometimes with projections like beads or rings. Some of the prettiest specimens are drawn Plate LXXII. figs. 24 and 25; also Fig. 26, in which both the knobs on the main stem are of bronze. Other specimens are drawn Plate LXXI. fig. 28, and Plate LXIX. figs. 1 to 9 and 13.

This kind of clasp is found very widely diffused, and was long in use. The same form was found in the bronze age, in the graves at Hallstadt, and in the Gallic tomb at Horgen, &c.

Plate LXIX. figs. 10, 11, and 12, and Plate LXX. figs. 1 to 5. Buckles. They consist chiefly of a ring or a quadrangular frame, by which they were fastened to the straps, and an arm-like appendage, on which is a knob, so as to lay hold of something at the other end of the strap. These implements had, however, a variety of forms, as may be seen by the drawings (Figs. 7 to 11, 14 and 22). The rings (Figs. 7 to 10), of which a large number have been found, are flat on one side and ornamented on the other.

Plate LXXII. fig. 17. Small pliers for the lamp, or for pulling out hair. More than a dozen of these implements have been found; the largest is 4¾ inches and the shortest 2 inches long.

* Plate LXXXI. fig. 3 (and Fig. 6, section) is not from Marin, but from Nidau; it has got into this plate by chance; it consists of two curved plates of iron holding a piece of wood between them with rivets.

They are made out of strips of plate, narrower at the top, where they bend round, than at the ends, which, in the largest specimens, are ¾ of an inch wide. In the specimen drawn, the arm or upper part diminishes to a thin round wire.

Plate LXX. figs. 12, 13, 15 to 21. Buttons or knobbed nails. The heads, some of which are round and some flat, are ornamented in various ways. Fig. 21 has a part of the wood still remaining in which it was fixed.

Plate LXXI. figs. 6 and 7, and Plate LXXVIII. figs. 5 and 6, are sickles. Fig. 6 of the first Plate approaches in shape those of the bronze age. Fig. 7 of the same Plate has the edge finely serrated.

Coins.—Some of those found here are Roman and some Gallic. Those of the first description are an As, a Tiberius, and a Claudius. Those of the latter are, *first*, a quarter-stater of gold, which has been found very commonly in Switzerland, and may be considered as having been the current money of the Helvetii. It is a bad imitation of the Macedonian coins of Philipp, and has on the obverse the head of Apollo with the fillet of laurel, and on the reverse a biga, with the emblem of a bird under the vehicle, and some letters which may be read ΦΙΛΙΠΠΟΥ. Very probably the gold was collected in the Aar and its tributaries, and the money coined in Aventicum. (Plate LXXXI. figs. 16 and 17.) (See vol. iii., page 12, of our Transactions; also the 'North Etruscan Alphabet' of Mommsen, vol. vii. page 244; and the 'Gallic Coins' of Dr. Meyer, vol. xv. page 19, of our Transactions.) *Secondly*, some Massilian silver coins (Fig. 19). *Thirdly*, several coins cast from a mixture of copper, lead, and tin (Potin), which are commonly found in the districts of the Helvetii, the Sequani, and the Ædui. On one side there is a head, and on the other the figure of a fanciful animal with a mane, short horns, and long tail. It is difficult to say whether a horse is intended to be represented. The workmanship is very rude. (Plate LXXXI. figs. 18, and 20 to 24.) (See Lambert, Essay, pp. 7 and 41; De Saulcy, Revue Num. 1860, page 168; and Meyer's 'Gallic Coins,' page 22.

ORIGIN AND AGE OF THE IRON IMPLEMENTS OF MARIN.

When these swords and other weapons were first discovered and published, I called attention to the fact that at that time there were no safe data on which to rely, and that their ornamentation was neither of a Roman nor of an Alemannic character, and also that it differed quite as much from those of the

Celtic implements hitherto met with, and that on all these accounts our judgment respecting them must be reserved till the matter had been further investigated.*

Since then, however, many important discoveries and investigations have brought this question nearer to its solution, and I will now bring forward the facts which bear upon this point, and mention the localities where similar swords have been found, and also state the conclusions that may be drawn from their form and ornamentation.

The discovery of a number of weapons in excavating the ditches of the fortress of Alesia (now Alise-Sainte-Reine) was of great importance in determining the origin of these iron implements. The swords found here, which without any doubt were lost in the conflict when this place was besieged (Cæsar, B. G., vii. c. 69-90), have been carefully described and drawn in the work before referred to, by M. Verchère de Reffye, in the 'Revue Archéologique' for November 1864.

Some very well-executed casts of these swords, for which our society has to thank the munificence of H.I.M. the Emperor of the French, enabled us to institute a careful comparison of them with our own. These weapons are, for the most part, so exactly like those of Marin that everything which M. de Reffye reports of them will also apply to the swords of Marin.

The place where they were found, as well as the marked difference between the character of these swords and lance-heads from those of the Romans, decide the question to which of the two sets of combatants these swords are to be ascribed. And thus are we able also to determine most satisfactorily the age when they were in use.

The information also is very instructive which is given by Mr. Franks on a series of weapons and other implements of bronze and iron, in the 'Horæ Ferales, or Studies in the Archæology of the Northern Nations,' by J. M. Kemble, page 172. These implements, given under the title of antiquities of the later Celtic period, consist of shields, helmets, coats of mail, swords, spears, daggers, horse trappings, metal-work for chariots, ornaments, and a number of objects of different uses. The swords have in

* Mr. Jules Quicherat, in his treatise published in the 'Revue Archéologique' (1865, p. 81), 'Examen des Armes d'Alise trouvées à Alise-Saint-Reine' affirms from a passage taken out of M. Troyon's 'Habitations lacustres,' p. 197, that the author of this volume had expressed an opinion that these swords were not of Celtic origin. He evidently had taken no notice of M. Troyon's remark, 'M. Koller, tout en suspendant son jugement sur l'origine de ces épées.'

general the same form and ornamentation as our own, and on most of them there is displayed a richness of decoration which bears a similar character, and indicates the same style of ornamentation.

Mr. Franks very justly lays claim to these swords as products of art by the Celtic nations, and especially by the inhabitants of the British Isles and of Northern Gaul; and he rejects the view that they had anything to do with the Etruscan, Roman, or Germanic races. The proofs of this may be examined in 'Horæ Ferales,' page 184.

If we carefully examine the designs upon our sword-sheaths we shall notice a peculiar ornamentation, the elements of which, small in number, consist of the waved line, the circle, and the triangle. But these designs have several appliances added to them. Thus, at the points of the triangle there are sometimes small flourishes not unlike the tendrils of the vine. Again, the circles are always found in pairs, and the two are joined together with a kind of strap, and recall the idea of the 'spectacle ornament' of the old Scottish monuments. (See Stuart's 'Sculptured Stones of Scotland.') Above this, in what may be called the tympanum, there are ornaments shaped like birds. Sometimes the whole design looks like a display of calligraphy. Representations of vegetable and animal life are wanting, with the exception of the fanciful animals, the extremities of which terminate in flourishes. The character of this ornamentation is connected with that of the late Celtic period brought before us by Mr. Franks, and is entirely different from the classic and oriental taste.

The antiquities found at Tiefenau also are of great importance in ascertaining the origin of the weapons of Marin; they have been described and drawn by the Baron de Bonstetten in two excellent treatises, one of them entitled 'Notice sur les Armes et Chariots de Guerre découverts à Tiefenau, près de Berne, en 1851.' Lausanne, 1852; and the second, 'Supplément au Recueil d'Antiquités Suisses.' Lausanne, 1860. Further notices respecting these antiquities will be found also in Jahn's 'Canton of Berne,' pp. 191 and 500.

The specimens found at Tiefenau may be classed according to the material into implements of iron, such as weapons, horse and chariot gear, ornaments, &c.; into those of bronze; those of clay, such as Gallic and Roman pottery; those of glass, such as rings or beads of variegated colours; and also Gallic coins of gold, silver, and bronze.

All these objects bear most unequivocally the character of the implements found at Marin, as may be seen by comparing the plates in the works just mentioned with those in this volume, and in some respects they agree exactly. Thus, the swords, spear-heads, bits, linchpin, ornamented rings, fibulæ, knobs, pliers, and coins, have perfectly analogous specimens amongst those of Marin. But amongst the things found at Tiefenau there are also some specimens rather different, which complete the warlike equipment, viz., fragments of ring-armour (lorica) and a dagger, portions of a war chariot, such as the tires of wheels, the nave, the linchpin, &c.

Further discoveries of weapons and implements of the kind just described have been made in many parts of northern and eastern France, in that part of Germany lying on the right bank of the Rhine, in Switzerland, and also, as above mentioned, in England. One single sword of this nature has been found in Hungary.*

The coins found mixed with these antiquities may be of some assistance in investigating their age. According to the determination of M. de Saulcy they consist of the following specimens:—15 plated silver drachmæ; 1 obolus, and 1 bronze coin of Massilia; 2 'Potin' coins of the Sequani; 1 silver coin of the Leuci; 1 Tulingic silver coin in imitation of the 'Philippus money;' and 1 bronze coin of the Parisii.

PLACE OF MANUFACTURE OF THE MARIN ANTIQUITIES.

The following facts result from the investigation of the arms and implements of Marin, and their comparison with the specimens found in England, Alesia, and Berne:—

The form of the swords and the lance-points, the ornamentation on the sword-sheaths, the marks on the sword-blades, the numerous Gallic coins found with them, and the widespread district where they occur, show that all the Marin antiquities have come from some of the workshops of Gaul, perhaps situated amongst the Belgæ.

The agreement between the warlike equipment of the Gauls, as mentioned in Diodorus, v. 30, with the antiquities found in Gaul and Britain, and also with many of those just described, is

* See the atlas to the 'Archæologiai Közlemények,' pt. ii. Plate V. The antiquities found in the tomb at Sinsheim belong to the category of the things found so abundantly in the tumuli of South Germany, Eastern France (Alsace), and Switzerland, and are quite different in character from the objects now under consideration.

very striking. Amongst the antiquities from Britain we find the long shields of the Gauls, with the figures of animals fastened on them; the lance-heads an ell long and two hand-breadths broad, and the spear-heads with wavy indentations.

In determining the age of the questionable specimens, the coins found with them are of the first importance. The Massilian gold and silver coins, and more especially the imitation of the 'Philippus money' in gold, appeared very early as the circulating medium of the chief emporium of Gaul, continued in use many centuries, and spread over a wide district; but they afford us just as little ground for determining the age as the 'Potin' coins of the different eastern provinces, which must have been in circulation at the time of Cæsar and Augustus. The Roman coins, the fragments of 'terra sigillata,' and the roofing tiles, give more definite information. With respect to the latter, we may assume with all certainty that there were here no roofing tiles before the founding of the knights' colony at Nyon, under Cæsar or Augustus, or before the establishment of the camp at Vindonissa; and in like manner there would have been just as little of the better kinds of Roman pottery for the table before the spread of Roman civilisation in the first century. The coin of Claudius, the latest of those found here in our country, may probably indicate that the occupation of the station of Marin was then drawing to a close.

We ought, however, to remark that we have not the slightest certainty that the few Roman objects found here had any connection with the Helvetian implements of iron, or with the lake dwelling. A great number of fragments of tiles occur in the soil of the bank where the piles stand; and not far off on the moor there are the remains of a Roman settlement, with heaps of fragments of tiles; in fact the whole district is full of the relics of Roman civilisation. And as at the mouth of the Broye, in the lake of Neuchâtel, and at that of the Thièle and the Scheuss in the lake of Bienne, and also on many shores both with and without pile dwellings, Roman implements, from causes unknown to us, have fallen into the water, so a similar chance may have occurred as to the Roman antiquities found at Marin, and we have no actual right to attribute them to the ancient inhabitants of the lake dwellings.

But if we regard the weapons and other iron implements as belonging to the lake dwelling, and thus bring down the existence of this station to historic times, and consider the Helvetii, well known in Roman history as, at one time, its

inhabitants, the question arises, why, when the Gallic people had made such advances in civilisation and in regular political relations, a kind of settlement should have continued to such a late period so little consonant with the requirements and development of their general mode of life. It may further be asked whether the lake dwelling was not affected by the events of the emigration of the Helvetian race and the destruction of their abodes.

We have already remarked that as yet excavations have only been made at a few points of small extent in the widely spread settlement of Marin, and the nature of this lake dwelling as a whole is as yet but little known. And it will not be till this locality has undergone a searching examination, and the materials for judging as to the character of this problematical settlement are laid before us in greater abundance, that we may possibly be able satisfactorily to answer these and many other questions respecting it.

In looking over the specimens from Marin what strikes us most is the fact that the weapons and other implements differ so essentially, both in material and form, from the products of the older settlements: not only has iron taken the place of bronze, but the form and ornamentation are so different that one is tempted at first sight to attribute their origin to another nationality and another district. But when we carefully consider this phenomenon it appears less striking. For if we compare the relics of a pure bronze station such as Morges with those of a pure stone station such as Wangen or Moosseedorf—that is of simple bronze implements with those of stone, wood, and bone—the difference between them, in whatever is necessary for sustaining life, is found to be much greater. It is certain that there are passages or transitions from the stone to the bronze period. On the one hand, we find a number of stations in which stone and bronze objects are mixed together in different proportions, and which reveal to us the gradual diffusion of metal tools. On the other hand, we can follow up the development of the art of bronze casting, and see how at first the implements of this material took the form of those of the stone age. The connection of the productions of bronze with those of the iron stations is less striking to the eye. There are indeed some forms of implements which remind us of those of the previous age. But, on the whole, when the Marin objects were made, iron had taken full possession of the field, and all the implements, including ornaments, which could

be made out of iron, a metal both firmer and more pliable, were manufactured out of this material. But the form of these specimens had in some measure undergone a change, for the working of iron is a totally different matter from that of bronze; and the hammer of the smith and the moulds of the founder cannot produce the same forms. The remains of the settlements of the pure stone, bronze, and iron ages indicate therefore epochs of civilisation amongst the inhabitants, separated by long intervals, while the end for which the lake dwellings were erected, viz. the security of person and property and their construction, remained the same.

Professor Desor, in the preface to his work above referred to, expresses the opinion that the Helvetii who came in as conquerors out of Germany, having become acquainted with the use of iron in their old abodes, introduced this metal and the coining of money into the country between the Alps and the Rhine.

We cannot refrain from once more repeating what we have stated in the previous parts of this volume. There can probably be no doubt that from the earliest ages the above-mentioned country, and also the land beyond the Jura, was inhabited by races of Celtic origin. But how can it be imagined that the inhabitants of our valleys, who had intercourse with the civilised nations on the shores of the Mediterranean by the paths of the Alps and the valley of the Rhine, had remained so far less civilised than the races dwelling immediately opposite to them between the Rhine, the Maine, and the Black Forest as to receive from them the knowledge of iron, &c.? But the monuments of the country, as well as the reports of historians,* teach us that the Helvetii from the earliest ages were in possession of this district, and besides this a careful examination of the passage in Tacitus (Germania, 28; compare Cæsar, B. G., vi. 24) shows that the question is not of a hostile attack on the Alpine district by the Helvetii living between the Rhine and the Maine (the district called in later times *Agri Decumates*), but of the return of a part of this nation to their old home south of the Rhine. Julius Cæsar, the highest authority, affirms that 'the power of the Gauls formerly was greater; so that it is credible that there had been an immigration of Gauls

* Amongst these we refer to the well-known story in Pliny, respecting the Helvetian Helico (Elicho of the Edit. Dalecampii), the original division of the country, and the power of the district of the Tigurini in the Cimbrian campaign, as well as the notices of Cæsar respecting the abodes of the Helvetii.

into Germany. For what obstacle would a river offer to prevent a nation which had grown great from passing it and occupying and holding the territories of those who had neither a common union nor any national power? Thus Helvetii held the country between the Hercynian Forest, the Rhine, and the Maine, and beyond them were Boii, both of them of Gallic race.'* 'The passage in Cæsar to which Tacitus refers runs thus: 'There was once a time when the Gauls surpassed the Germans in bravery, nay, they even attacked them, and, as they had a surplus population and were straitened for land, they sent colonies over the Rhine. Thus Tectosagi occupied the most fruitful parts of Germany about the Hercynian Forest and settled there.' The Helvetii, like these people, had also widened their borders and possessed a portion of the country on the other side of the Rhine until they were forced by the Germans to surrender it again in order to protect the borders of their own homes from the conqueror. So that we have nothing to do with any hostile irruption nor of any migration of the whole race. But, in any case, this event happened at a much earlier period than that of the implements and coins of Marin, which belong to the time immediately before the people were Romanised, and bring to our view a very advanced state of civilisation and the best productions of Gallic art. The migration of the Helvetii consequently is not at all connected with the introduction of Gallic iron articles into the district of the lake of Neuchâtel. There can probably be no doubt that iron, like bronze, gradually spread over Gaul, as it did over the rest of Europe. If the people of the bronze age are different from those of the iron age, a proposition which can neither be denied nor has yet been proved, such a change of population is by no means to be connected with the diffusion of iron implements.

* Validiores olim Gallorum res fuisse, summus auctorum D. Julius tradit: eoque credibile est etiam Gallos in Germaniam transgressos. Quantulum enim amnis obstabat, quominus, ut quæque gens evaluerat, occuparet permutaretque sedes, promiscuas adhuc et nulla regnorum potentia divisas? Igitur inter Hercyniam silvam Rhenumque et Mœnum amnes Helvetii, ulteriora Boii, Gallica utraque gens, tenuere. (Tacitus, *Ger.* 28.)

Ac fuit antea tempus, cum Germanos Galli virtute superarent, et ultro bella inferrent, propter hominum multitudinem agrique inopiam trans Rhenum colonias mitterent. Itaque ea quæ fertilissima Germaniæ sunt loca circum Hercyniam sylvam Volcæ Tectosages occupaverunt atque ibi considerunt. (Cæsar, *B. G.* vi. 24.)

GEOGRAPHICAL LIST

OF THE

LAKE DWELLINGS IN SWITZERLAND AND THE NEIGHBOURING COUNTRIES.

It was proposed in the early part of this volume, first, to give a detailed account of the most typical lake dwellings, or of those which have been most carefully examined; and, afterwards, to make out a geographical list of all the lake settlements worth mentioning known in the Swiss district. The first part has already been completed; the second now claims our attention.

A catalogue like this, however insignificant the information may appear which in some cases is all that can be obtained, may possibly be useful in two ways: first, as a guide to those who are investigating these singular settlements, and, secondly, to convince antiquaries at a distance that this peculiar mode of living was not a chance, or a temporary fancy, but that it was the settled habit of a widely spread race for century after century. Who shall say how far back this range of centuries extends?

For the sake of convenient subdivision, we will take the country north of the high Alps first, and we will begin at the east. On this plan the lake of Constance naturally first presents itself to our notice.

LAKE OF CONSTANCE.

Eastern or Main Portion.

HAGENAU.—A lake dwelling was discovered here in February 1866 by Mr. Walter, of Constance. Rows of piles were met with, together with stone celts and other implements.

Western Portion, including the Ueberlinger See and the Unter-See.

The shores of this part of the lake are probably more thickly studded with settlements than those of any other Swiss lake.

In fact, here are found happily united all the requirements necessary for the erection of dwellings of this nature. A deposit of shell marl stretching along nearly the whole of its shores and of tolerable breadth; a rich tract of country between the shore and the hills, which rise gently behind; forests of pine and oak; pleasant bays with a gravelly bottom; a great abundance of fish in the lake, and a superfluity of game in the surrounding forests, were circumstances highly favourable to the colonisation of these shores.

Many, if not most of the settlements on this portion of the lake (and probably also of the eastern part, though this has not yet been carefully examined), reached back to the earliest ages, that of the stone period; and till lately they were thought to have ceased to exist before the beginning of the bronze period. Some late discoveries, it will be seen, have proved the incorrectness of this opinion, as in some stations numerous implements of bronze have been found where previously nothing had been met with but implements of the stone age.

The settlements on this part of the lake are almost without exception of considerable extent, and they have this striking peculiarity, they are situated quite near to the shore, nay, in some cases they actually touch it. The facts that implements of all kinds and remains of these ruined colonies are found here in extraordinary numbers, and lying on beds one over the other, together with some other circumstances, indicate that these settlements had existed for many centuries.

UEBERLINGER SEE.

UNTER-UHLDINGEN
MAURACH
NUSSDORF
SIPPLINGEN
see page 102.

BODMANN
WALLHAUSEN
LUETZELSTETTEN
MAINAU
see page 96.

UNTER-SEE.

ALLENSBACH and HEGNE, see page 88.
MARKELFINGEN, see page 87.
IZNANG.—A large number of piles are seen both above and

below the landing-place, chiefly below. Stone celts were found here.

HORNSTAD.—A little above the houses of Hornstad there is a great settlement in the part of the lake called the 'Zeller-See.' Stone celts and broken pottery were found here.

GAIENHOFEN.—Above the landing-place are the remains of an extensive settlement. A little brook here runs into the lake, so that part of it is covered up with mud. Stone celts are frequently found.

HEMMENHOFEN.—Above the town is a lake settlement in which stone celts have been found. Another settlement lies out in the lake immediately in front of the millstream, and is as large as the whole modern village. The place is called 'im Allmend.' The piles are numerous. Stone celts are found on the bottom, which is gravelly.

WANGEN.—For a description of this well-known settlement, see page 60.

OBERSTAAD.—In the bay between this place and Kattenhorn is a lake dwelling which reaches to the shore, and appears to be as extensive as that of Wangen, though the piles are not very numerous. Antiquities found—stone celts and pottery.

STEIN.—Just where the Rhine runs out of the Unter-See, there is a lake settlement. The piles are at a small distance from the island of Weerd and the remains of a Roman bridge found there in the direction of the lake; they are scattered and isolated between both banks; the greater part of them have probably been taken up, as they impeded navigation, and must have been a hindrance to the fishermen.

NEUENBURGER HORN.—This place was examined in February 1861, by the Historical Society of Thurgau, and the excavations were directed by Mr. Messikomer. It is situated above Mammern, very close to the Taubmühle. Here a bay extends at the foot of a steep declivity, open to the north-west; the shallow ground is from 200 to 250 feet broad. The piles begin at a distance of about 160 feet from the shore, and appear to extend for about 400 feet, following the course of the shore. The greater part of it is covered with sand or mud. The space over which it extends seems to be more than 39,000 square feet. The piles which are still visible project about a foot above the bottom, and are from three to four inches in diameter. They consist of oak, fir, and alder, but are so rotten that it is impossible to draw up a single pile. No antiquities were found by digging in the ground. Everything discovered lay on the sur-

face, and consisted of stone celts, small flint implements, pottery, and bones; one grinding slab, deeply furrowed, was found; but no small bone tools, nor a trace of any material for food. But the force of the water is very great here in rough weather, so that probably the smaller objects have been washed away. This place, however, affords a rich harvest of stone celts; they have been found here by hundreds. It appears as if there had been a regular manufactory of them. And as there was no wide-spread layer of ashes, and only small patches were found here and there, we may conclude that this settlement was not destroyed like Wangen by violence, or at any rate by fire; we may probably also assume that the inhabitants left these lake dwellings of their own accord, and did not carry off with them to their new abodes their old stone implements, but left them behind as useless things of the past, and hence apparently they all lie on the surface.

Feldbach.—This settlement stretches from Feldbach to what is called the jetty, and occupies the whole bay. At the upper part it has been rather covered with sand by the brook which here runs into the lake. Groups of piles are visible in many places. Stone celts and stags' horns are found here.

Above Steckborn.—This settlement begins near the further houses above the little town of Steckborn, and extends over the bay. The piles project only a very little above the lake bottom. Stone implements are found here.

Above Berlingen.—The piles here are not readily discernible, but they begin above the town near the furthest houses, and extend over the bay. Stone celts have been found all along the shore.

Below Ermatingen.—This settlement occupies the bay below the village; the piles in untold numbers project about half a foot above the lake bottom; a considerable portion of the whole area is covered with fine sand. Many stone implements are found where there is gravel, but the ground in general is not gravelly; there are only a few whole round stones. On the contrary, however, there are a very large number of fragments of stone arising from the manufacture of stone celts. One of the celts found was of nephrite. Flint flakes, the refuse from the manufacture of flint tools and weapons, were found in immense numbers; though flint knives and arrow-heads are rather rare. This station appears to have been voluntarily abandoned, for though the ground has been excavated to the depth of three feet, no black earth or burnt wood has been met with, and no

other supposition will explain the comparatively few stone implements found here.

LAKE OF NUSSBAUMEN.

At the southern spur of the heights between the Unter-See and the Thur, in the open valley between Stein and Frauenfeld, are three small lakes joined together; the Upper, the Lower, and the Hasen lakes. The two first take rather more than half an hour to walk round them. These lakes are for the most part filled with reeds, and are very full of fish. In the first, which also goes by the name of the lake of Nussbaum, there is a little island, on which Professor von Morlot has discovered piles and other indisputable evidences of a lake dwelling.

NIEDERWYL, near FRAUENFELD, see page 69.

LAKE OF PFAEFFIKON.

PFAEFFIKON (?)
IRGENHAUSEN
HIMMERICH (?)
ROBENHAUSEN
RIEDBUEHL (?)

see page 37.

LAKE OF GREIFFENSEE.

No settlement was positively known in this lake until February 1866, when the water was very low, and an actual lake dwelling was discovered by Mr. Messikomer. It lies in the immediate neighbourhood of the brick-kilns of Riedikon, and extends over about an acre. It is nearly a hundred feet from the shore, and the depth of water is from three to four feet. The antiquities found here are flints, stone celts, broken hazelnuts, pottery, and grains of barley. The bottom is covered with a mass of broken stones.

LAKE OF ZÜRICH.

MAENEDORF.—In the winter between 1843 and 1844 the water was very low, and advantage was taken of this to deepen the harbour near the last houses at Mänedorf in the direction of Uetikon. The place of excavation was only a few paces from the present bank. Before digging far, the workmen came upon a blackish alluvial earth, which, when thrown out, gave a

peculiar odour; it had been formed by the decay of wood and animal matter, and was advantageously used as manure on the neighbouring meadows. In this earth were found bones and horns of animals, many kinds of implements, and a number of very perfect stone celts, some of which are in the museum of the Zürich Society, but many specimens were broken to pieces or thrown again into the lake; they are all of pretty spotted serpentine, and are remarkable for their size, for the careful workmanship, and for the fact that the posterior part, after having been ground, has again been hewn and made rough. From information obtained by the author after repeated visits to the place, it was very evident that a lake dwelling formerly existed here, and this was mentioned in the first report on the lake dwellings made to the Zürich Antiquarian Association. Thus the matter rested, till the early part of the year 1865, when circumstances occurred to confirm the opinion expressed several years before. It was found necessary to deepen the small harbour where the antiquities had previously been found, and a space of about eighty feet long by thirty feet broad was excavated to the depth of about four feet. In doing this the regular substructure of the lake dwelling came to light. The piles, some of oak, and some of fir, stood so close together that not even a single pile could have stood between them. The antiquities found during this excavation are precisely similar to those of other lake dwellings of the stone age, such as Meilen, &c. It is, however, proved that this settlement lasted till the beginning of the bronze age, as a portion of a crucible exactly like those found at Robenhausen both in shape and material was discovered here.

ZÜRICH.—Just at the outlet of the lake, between the place called the 'Bauschanze' and the Hôtel Baur au Lac when several years ago, and again in the winter of 1857, the mud-machine was used in the bed of the river, several antiquities were brought up; they consisted of the heads of piles, whole stags' horns with incisions, and with the ends cut off; also pieces of horn intended for haftings, together with bones and corn-crushers. Unfortunately the soil in which these things were found was not thrown on the mainland, but taken away to the depths of the lake. There can be no doubt of the existence of a considerable lake dwelling on this spot. It is well known that in the first decade of this century the promenade in front of the Stadthaus still formed part of the lake, and was a favourite bathing-place. Elderly people

(amongst whom is the author himself) remember quite distinctly the stumps of piles projecting here in great numbers out of the mud. At the present time, as the actual site of the lake dwellings is covered with earth, only a few dozen are to be seen at the eastern extremity of the settlement.

LAKE OF ZUG.

Several lake dwellings have been found on the banks of this lake. See page 123.

LAKE OF BALDEGG.

Colonel Schwab has found the remains of five lake dwellings on this lake; one of them is situated not far from the mouth of the Aa. The piles are spread over about 14,500 square feet; they are not numerous; some of them may be observed at a depth of fifteen feet just where the lake becomes suddenly deep. Fragments of pottery are found here. The other four settlements are situated close to the bank, on what is now dry land, and can only be investigated by regular excavation.

LAKE OF SEMPACH.

The earliest information as to lake dwellings in this lake was communicated by the Rev. Jos. Boelsterli. In the year 1806 the water was six or eight feet lower than usual. The strand then became about 200 feet in breadth, and a number of piles were exposed which had previously been covered with very shallow water. These piles are said to have been a foot in diameter, and, when drawn up, to have been twelve feet long. About forty piles were found together; some Celtic weapons (described in the seventh volume of the 'Geschichtsfreund') and also pins and other implements were found here.

Since then Colonel Schwab has submitted the lake to a more complete examination. The settlements run along the shore, and are not broad, as the lake becomes deeper at some little distance from the shore. The remains of the lake dwellings do not lie deep in the ground, for the peat on the average is only a foot thick. The stone implements of Schenken and Eich do not differ in material from those of other settlements, but they are especially remarkable for careful workmanship; in fact, they are amongst the best things of the kind found in the lake dwellings. They are all deposited in the Antiquarian Collection at Lucerne.

At the north end of the lake of Sempach, a tongue of land, about 300 feet broad, runs nearly 600 feet into the water, and appears to consist of gravel from the neighbouring moraine of Mariazell, which forms the termination of the lake in that direction. Here at almost every step fragments of Celtic pottery are met with. The lake dwelling itself is seen in the shape of a few piles in the neighbourhood of the bank.

Very near this place, in dry ground, hardly twenty feet from the water, and only a foot under the surface, a number of antiquities were discovered; they consisted of nineteen bronze armlets, one bronze sickle, two bronze celts with shaft flanges, one broken stone hammer, and two corn-crushers. At another place, a short distance off, there was found a human skull, also a lance-head, a hairpin, and a gouge of bronze, together with pottery, wild boars' tusks made into tools, and the bones of pigs. But neither the owner of the land nor the antiquaries have been able to decide whether these specimens really belonged to a lake dwelling, or had been brought here in the earth from some neighbouring locality. The presence of a number of horses' ribs, which were found here, may be explained by the supposition that this was the place where they were skinned. The small but singular earthenware vessel (Plate XXII., fig. 15) was found here.

The following is a list of the chief settlements in the lake of Sempach:—

SEMPACH.—EICH.—This settlement is now entirely on dry land; numerous piles are found on excavation over an area of about 58,000 square feet. Flint flakes and arrow-heads, a bronze celt, and a wooden club were the antiquities discovered here.

SCHENKEN.—This station contains about 97,000 square feet; about half of which is now on dry land. The specimens found here were flint arrow-heads, and fragments of pottery.

LITTLE ISLAND.—On the north-west of this little island an area of about 200 square feet, formerly covered with water, is sparingly studded with piles. The antiquities found here consist of pottery, stone celts, flint flakes, and arrow-heads, and the head of a bronze hairpin.

MARIAZELL.—The whole of this settlement, which contains about 29,000 square feet, has been dry since the level of the lake was lowered in the year 1806. Probably the bronze implements mentioned above were found here. The antiquities found by Colonel Schwab consist of flint flakes, two stone spindle-whorls, a stone celt, and an iron knife.

MARGRETHEN.—NOTTWYL.—In front of this place, at a depth of fifteen feet, there is a double row of piles.

Between NOTTWYL and SEMPACH. Piles are to be seen at the mouth of a brook.

LAKE OF MAUENSEE.

This little lake is connected with that of Wauwyl, which is still smaller. Colonel Schwab has found piles at two places, viz., opposite to Wauwyl and Kaltbach, and he is convinced that an excavation on the little island would reveal the remains of a settlement. Flint arrow-heads were found at the locality first named.

LAKE OF WAUWYL.—See page 77.

LAKE OF INKWYL.

About an hour's walk south of the little town of Wangen, not far from Soleure, the lake of Inkwyl lies in a boggy plain; it is about twenty minutes' walk in circumference, from eighteen to thirty feet deep, and is covered at the bottom with mud. This little sheet of water abounds in fish, is completely frozen over every winter, and is not open again till April. In the middle of it there is an artificial island, rising about ten feet above the level of the water, tolerably round, and about fifty feet in diameter, over which a wooden stage extends about six or seven feet underground, made of cross pieces of fir-wood (now indeed quite rotten), and resting on oak piles from three to four feet apart. There is a layer of black earth about one foot thick which covers it, and which contains the greatest number of antiquities. Immediately under the cross beams there is a bed of whitish slimy earth filled with many small shells, which is a proof that the platform with the huts upon it stood above the water, and that the piles which supported it had been driven into a shallow part of the lake.

This settlement was discovered by Professor von Morlot in September 1854, and described in the work 'The Lake Dwellings of Moosseedorfsee, in the canton of Bern,' by A. Jahn and J. J. Uhlmann. The results of the subsequent excavations, undertaken by Mr. Amiet of Soleure, in November 1857, and by Mr. Roth, the proprietor of the island, in April 1858, were published by Mr. A. Jahn in the 'Anzeiger für Schweizerische Geschichte und Alterthumskunde:' 1858, No. 4. In many points this station seems very similar to the Irish crannoges.

The implements found here were stone celts of nephrite and serpentine hafted with stag's horn; many cutting instruments of flint, barbed arrow-heads of the same material, corn-crushers, and slabs of sandstone for grinding the hatchets; pointed tools of all sorts, made out of bones, especially those of the stag; wild boars' tusks, some of them perforated; an immense number of fragments of pottery, some made from coarser and some from finer materials, and in some cases ornamented with patterns of lines; fragments of bowls of potstone, clay spindle-whorls, some bronze fish-hooks (?), and, lastly, an iron implement which appears to date from the Roman age. Some objects of very soft sandstone are particularly interesting, which are drawn and described in the above-named number of the 'Anzeiger.'

Plate XXXIX. fig. 2 represents one of the small earthenware rings used as net-sinkers. This specimen has the furrow still remaining which was worn by the cord. It seems now clear that these smaller rings were net-weights, while most of the larger ones were supports for the conical-footed earthenware vessels. The large rings with very small openings and the small rings with very large ones are somewhat difficult to understand.

LAKE OF MOOSSEEDORF.—See page 31.

LAKE OF BIENNE.

The plan drawn Plate LVI. shows the situation of the lake-dwellings known in this lake. It is entirely by the exertions of Colonel Schwab that we have obtained so much information respecting them. The letters S and B indicate settlements of the stone and bronze periods, but here in this lake we shall find two other letters. I indicates that the settlement was in existence during the iron age, and R that a number of Roman remains are found in its ruins. Whether settlements of this nature were actually inhabited in Roman times remains yet to be decisively proved.

Twenty-one settlements are known on this lake, as will be seen by the plan; a few particulars will now be given of those which are of the most importance.

NIDAU.—See page 132.

GRASEREN.—An inconsiderable settlement very much covered with mud, probably occupied by a small number of inhabitants. It lies about 200 feet from the shore. The following antiquities

were found here:—A dagger, the handle ornamented with silver wire; knives, sickles, and other implements of iron; mealstones, slingstones, and corn-crushers.

SUTZ.—This place is about half an hour's walk from Nidau; Roman buildings have been found in the neighbourhood, viz., in the Schlattwald and on the banks of the lake below the church. About 100 or 150 feet from the shore piles are seen like those of Nidau, about six feet under water, and hardly projecting a foot above the bottom. The ground here consists of loamy mud, but in parts it is covered with roundish gravel and granite stones, which the inhabitants think have been collected from the neighbouring cliffs and sunk here; the whole space, however, about 2 acres in extent, where the heads of piles are occasionally seen, is only a trifle higher than the surrounding parts. The piles, so far as they have been examined, appear to be of oak, and seem to be thicker than those of Nidau. No horizontal balks have yet been found here. The distance between the piles seems very irregular; sometimes they are a foot apart, sometimes several feet, and sometimes only six inches; they run occasionally parallel with the bank, and then again they take a turn, and incline towards the shore in either a straight or curved line. The wood found here shows traces of burning, and the few earthenware vessels met with were also filled with charcoal. A bronze celt was found here which had the half of the shaft between the flanges turned into charcoal. In short, the appearance of most of the specimens, together with the black muddy bottom, may be taken as a proof that the settlement here was destroyed by fire. To the antiquities already mentioned may be added a bronze sword, Plate XLII. fig. 4; two iron lance-points, Plate XLII. fig. 2, and a millstone made after the Roman fashion. Plate XLII. fig. 1 shows two views of a kind of hammer-pick, made of serpentine, with a hollow in the middle to allow of its being held firmly, and Figs. 10 and 11 are two rods made of oak, which evidently have been lances: the section is shown on one side of the figures. Several of these weapons have been found both here and at Nidau. Both ends were brought to a point; they were not made of whole branches, but were portions of split stems of oak. There was also found a flint tongue or flake five inches long, and one inch broad, flat on one side, and on the other shaped like a roof. Whether it was a lance-point of very early age, or was destined for some other purpose, we will not attempt to decide. Fig. 14 is the sketch of a very singular bronze hook with three blunt teeth:

the use of this implement is unknown. The bronze sword drawn Fig. 7 was found between Sutz and Lattringen.

LATTRINGEN.—Near this village, which is about ten minutes' walk from Sutz, there are two places in the lake where piles are seen. One of them lies immediately in front of the little harbour, is about three or four acres in extent, and approaches to within twenty feet of the shore. The depth of the water is from six to eight feet, as is generally the case in this neighbourhood. It does not appear that the settlement was formed on any artificial elevation of the bottom. The piles are placed very irregularly, and project only a few inches from the bottom, which is unfortunately very much covered with mud; and this renders the investigation somewhat difficult. The antiquities found here consist of a bronze dagger, Plate XLII. fig. 3; a bronze shovel-shaped celt; a bronze hook, Fig. 13; a spiral ring of bronze; some corn-crushers made of pebbles; a stone with cavities both above and below, and which doubtless served as a mortar or mealing-stone for crushing corn, like that from Nidau, drawn Plate XXXVIII. fig. 5, and some coarse pottery.

Above LATTRINGEN.—About 500 or 600 feet from the last-named settlement there is a circular elevation in the bed of the lake, about forty feet in diameter, where piles are found. This submerged mound is about eight feet below the surface, while between it and the shore the depth is ten feet, and on the other side towards the lake the water is thirteen feet deep. There appears to have been here quite a low dam with piles, joining the settlement and the land together. The piles, which are scattered, and few in number, project about a foot or a foot and a half above the bed of the lake. The bottom is very much covered with mud. The horn of a roe (?) was dredged up here, and also pottery, which in shape and quality is precisely similar to what has been previously described.

MÖRINGEN.—This village is situated about a quarter of an hour's walk from the place last mentioned, on a bay the northern portion of which is called the nook of Möringen; its position will be seen on the map in Plate XL. In the middle of this bay there is an elevation of the bottom covered by about six feet or six feet and a half of water. Although this place is only higher than the space between it and the shore by about a foot, yet it has received the name of the Steinberg chiefly from the number of stones which are scattered about upon it artificially. The Steinberg of Möringen is about half an acre in extent, and is about 300 feet from the shore. The piles are not very numerous,

they are placed irregularly, and project about one foot from the bottom. Horizontal beams have been found here sunk in the deep mud. In fact, a very large quantity of wood lies about on the bed of the lake, the appearance of which, with other tokens, proves that the settlement was destroyed by fire. Möringen was the first place which was known to M. Müller as a locality for antiquities, and which he first worked to advantage; and for three years he enriched his cabinet from this place with many interesting specimens. The following may be especially mentioned:—Several bronze celts; some armlets of bronze wire; clay rings of different sizes, exactly like those found at the Nidau Steinberg; a whole series of perfect earthenware pots, bowls, and drinking-cups, made of the material already described; an iron sword in good preservation, drawn one-fifth of its actual size, Plate XL. figs. 2 and 5; and a remarkable iron fork 8½ inches long, provided with appendages at the sides, Fig. 3.

Colonel Schwab also procured from this place many interesting antiquities; he found charred apples, rope made of bast, cords made of flax, grains of wheat, small beans, &c.

From his numerous collection the following objects have been selected to be drawn.

Plate XLI. figs. 1 and 2 bronze knives; fig. 2 is hafted with stag's horn; fig. 3, bronze pin; figs. 4 and 5, different views of a bronze celt of a form unusual in the lake dwellings; fig. 7, a round bronze plate ornamented with knobs; fig. 11 is a small bronze awl fixed in a wooden handle. Plate XCV. figs. 3, 4, and 5, are three round plates of bronze ornamented in different ways. Plate XLI. fig. 17, bronze implement for suspension. Plate XLII. fig. 8, one of the well-known 'moon-images' of bronze: this specimen is sharp at the outer edge; fig. 9 is a bronze knife of very elegant form and beautiful ornamentation. The number and variety of the bronze knives found in the lake dwellings have already been mentioned in the account of Nidau, but this knife is probably the most beautiful of any that have yet been found.*

* Sir Gardner Wilkinson has kindly pointed out to me the great similarity, if not identity, both in form and ornamentation, between this knife and one which he found at Thebes, of which the accompanying woodcut is a representation taken from a sketch obligingly communicated by him

Several rather peculiar specimens of earthenware have been found here. Plate XLI. fig. 10 is part of a vessel with a kind of spout; figs. 12 and 14 are shaped like saucers; figs. 15 and 16 are different views of a fragment of a vessel in which the handle is made inside; fig. 18 is a drinking-cup. Plate XLII. fig. 16 is one of the regular 'moon-images' of earthenware, ornamented with vertical lines arranged in irregular groups. Plate XXII. figs. 27 and 28 represent a cup with feet, an arrangement which is very rare in the lake dwellings. Plate XLI. fig. 6 is a bone arrow-head; fig. 9 is a weaver's shuttle, also of bone. Fig. 13 is a string of beads made of glass and amber, and also three spirals of bronze.

Of wood, Fig. 8 is the drawing of a large mallet, and Plate XLII. fig. 6 is a cup with a handle cut out of yew-wood, and not of maple-wood, as was at first imagined. Plate XL. fig. 4 is the drawing of what is called an 'Einbaum,' or canoe, made out of a single stem: three of these may be seen in the vicinity of Möringen.*

A large number of bones are lying about on the lake bottom; it would be highly desirable to have them collected and determined.

Below HAGENECK.—Above the village of Täuffelen, in a direct line below the houses at Hageneck, a number of rather small piles are to be seen about 100 feet from the shore and at a depth of about four feet. They project from the muddy bottom about a foot or a foot and a half, and probably cover an area of about an acre. From the depth of the water this place did not offer any good results, and consequently it has not been thoroughly examined. Some fragments of pottery, however, have been found there, and these, together with the piles, prove that it was the site of a settlement.

PETER'S ISLAND.—This island, which in ancient times probably bore the name of Ubinowa ('Obere Aue,' the u island), in contrast with Nidau (the lower land or island), has

Sir Gardner's opinion is that this knife is of a Gaulish type, and he accounts for its presence at Thebes by the fact well known in history that Ptolemy Philadelphus had in his service a troop of Gaulish soldiers, and that others of the same nation were employed by the celebrated Cleopatra. It is singular that an illustration of lake dwelling antiquities should come from the far-distant land of Egypt, but anyone who compares the two knives will be struck with the resemblance, and will be satisfied that the ornamentation in both cases springs from the same source.—[TR.]

* Similar boats are still in use in some parts of Switzerland, as, for instance, in the lakes of Lucerne, Zug, and Aegeri (in the Canton of Zug). On the banks of the latter lake they are still manufactured; and Dr. Keller informs me that in the spring of this year he saw a boat of this description in the harbour of the town of Zug.—[TR.]

on the south side the remains of an extensive settlement. The piles are from one to two feet apart, and stand in rows which for the most part run parallel with the bank, at a distance from it of about thirty or forty feet; the breadth of the piled space here is hardly as wide, because the lake bottom suddenly deepens. The bottom is exceedingly muddy, so that there is great difficulty in investigating it. The piles project about one or two inches from the bottom, and probably extend over two acres. One object found here especially claims the attention of antiquaries; it is a canoe or boat (Einbaum) sunk in the mud at the north end of the island, about fifty feet long and three and a half or four feet wide, so that it must have been made out of a colossal trunk. As it is filled with stones, and lies near a heap of stones, there can be no doubt that it went down from overloading. We have therefore here a matter-of-fact proof that the places in the lake selected for settlements were really covered over intentionally with a bed of stones.

The bronze pin drawn Plate XXXIX. fig. 4 was found here.

Little Island.—(Kanincheninsel). On the western side of this little island, portions of Roman roofing tiles and fragments of pottery have been found in great numbers; but on the south side, the former steward of Peter's Island noticed a group of piles projecting about two inches high above the mud bottom, which in all probability mark the site of a lake settlement. Colonel Schwab has lately investigated this locality, and found objects of the stone, the bronze, and the Gallo-Roman periods all mixed together. Forty Roman coins have been discovered here. The little gold ornament drawn Plate XLII. fig. 5, was found at this place.

Above Ligerz.—This settlement is about forty or fifty feet from the shore; the extent is about 3,850 square feet, the average depth of water is about eight feet; the piles are scattered and thin.

Vingelz.—This settlement is situated about 2,950 feet from the shore, and covers an area of about 39,000 square feet. The water is fifteen feet deep. The antiquities found here were meal-stones, corn-crushers, great stones for weights with iron rings, sling-stones, and pottery. This settlement is so far from shore that at one time it was thought probable that there might be a kind of pile-bridge connection with the opposite station of Nidau; but on further examination, this idea has been given up: it has not been proved.

Between Vingelz and Bienne is a raised elevation on the bed of the lake, covered with stones, but without any visible piles. Colonel Schwab got two iron javelins from this place. The bronze hook drawn Plate XLII. fig. 12 was found at the mouth of the Scheuss. The pin, Fig. 13, came also from the same locality, as also the ornament of iron, Plate XXXIX. fig. 9.

LAKE OF NEUCHÂTEL.

The banks of this lake, like those of the lake of Bienne, were studded with settlements, the eastern side more especially, offering many favourable localities from the gradual deepening of the water and the broad shallow margin (weisser Grund, blanc fond). It will be seen from the notices of the various settlements, and of the objects found in them, that some date from the earliest age, that others continued during the Helvetian times, and that not a few were inhabited even after the Roman occupation during the Gallo-Roman period of Helvetia. It remains yet to be proved whether any lasted to a still later age, though the present evidence seems to point to the contrary.

For the following notices as to the settlements on this lake, and the antiquities found in them, I am indebted almost entirely to Colonel Frederick Schwab of Bienne, who is rendering very great service to archæology by his zealous and careful investigation of these singular settlements. It is from his information that the maps of the lakes of Neuchâtel, Bienne, and Morat on Plate LVI. have been drawn. It need hardly be mentioned that in the plan of the Neuchâtel lake the letters S B I and R mean the same as in the plan of the lake of Bienne. As the settlements in the lake of Neuchâtel are so numerous, and there are not always places in proximity from which they might be named, Colonel Schwab has numbered these stations from one to fifty. The present map is simply a reproduction of his former one, with the addition of a few lake dwellings lately discovered.

1 and 2. A LA TÈNE, PRÉ FARGIER, AND MARIN.—These settlements, though given under two numbers, are one and the same lake dwelling; a full account of the place and its antiquities will be found on page 239, and in order to prevent confusion it has been called Marin.

3. HAUTERIVE.—There is here a large settlement extending over about 117,000 square feet; the water is from four to six

feet deep. Two iron spear-heads and some pottery were found here by Colonel Schwab. This station has subsequently been investigated by Professor Desor, who has discovered a 'Steinberg,' or artificial elevation, very similar to that of Auvernier. No metal implement has been found on either 'Steinberg,' only bone and flint weapons; but pottery has been met with on that of Hauterive. The depth of water on the Steinberg at Hauterive is greater than on that of Auvernier.

4 and 5. Monruz.

6. Crêt.—A small settlement. An implement was found here like a cylindrical roller, with an iron hook at each end. It weighed about a quarter of a hundred-weight, and the letters I R were engraved upon it; several stone chisels were also met with here, and a great stone with a large cavity.

7, 8, 9. Auvernier.—See page 153.

10 and 11. Colombier.—In one of these settlements no actual piles are visible, but there is a subaqueous elevation, made of stones, chiefly broken; a quantity of burnt wood, however, has been noticed, and flint knives have been found here. The other settlement stands near the shore, and exhibits low piles. Flint implements, celts made of serpentine, and Roman tiles, have been found here.

12. A settlement about 70 feet from land. Depth of water, 16 feet. Roman pottery and tiles were found here.

13, 14, 15. Cortaillod.—See page 148.

16, 17, 18. Bevaix.—One of these settlements is near the Abbaye and another near the mill. Colonel Schwab has lately procured from these localities bronze hairpins, pottery, bones, and the handsome bronze knife drawn Plate XLVII. fig. 6. The station most to the south is about 90 feet from the land, and extends over an area of 97,000 square feet. Depth of water, 15 feet; it appears to be richer in antiquities than the other two.

19. Chez les Moines.—A settlement about 100 feet from land. Depth of water, 4 feet. The area is about 77,000 square feet, with a raised portion called the 'Ténevière.' The antiquities found here consist of pieces of stag's horn, stone chisels, and fragments of Roman tiles. Grass grows on this locality.

20. Near St. Aubin.—The extent of this lake dwelling is about 106,000 square feet. The piles extend to the shore. On the lake side the depth of water is about 5 feet. A quantity of pottery was found here, stone plummets or weights, bones, and

pieces of stag's horn. Dr. Clément has obtained from this station an excellent collection of objects of the stone age.

21 to 29 are fully described in the report given by M. Louis Rochat, on the lake dwellings in the neighbourhood of Yverdon. They comprise the well-known names of Concise, Corcelettes, and Les Uttins. M. Rochat's report will be found from page 168 to page 182. Perhaps it may be well to mention that No. 23 is reported by Colonel Schwab to be about 126,000 square feet in extent, and that here also the piles extend to the land; those which are the farthest in the lake stand in water ten feet deep.

30. YVONAND.—A 'Berg,' or subaqueous hillock, without piles and deeply covered with mud.

31.

32. FONT.—One of the most remarkable antiquities found here is the cupped or hollowed stone drawn Plate XXXIX. fig. 12. It is well known that stones with this peculiarity are met with in nearly all the countries formerly inhabited by the Celts. They have been found in the lake of Neuchâtel at Corcelettes, at Font, above Estavayer, and at the lake dwelling of Cortaillod, just opposite the shore, almost always in places which are dry at low water.

The implements met with in the neighbourhood of these hollowed stones belong in general to the bronze age. The cups vary from three to ten inches in diameter; they are seldom more than an inch in depth. They are made on the surface of the stone without any kind of order, except that when they are three in number they form as it were the points of an equilateral triangle, as may be seen in the drawing. The number of hollows or cups varies exceedingly; sometimes, as in the stones found in the lake dwellings above mentioned, there is only one, but more frequently there are from ten to twenty. A stone in the collection of Colonel Schwab, weighing about five hundred-weight, is remarkable for having on one side a single hollow a foot in diameter, and on the other eight smaller hollows. These stones do not show the least trace of work except the cups; they are all made out of erratic blocks, and chiefly of granite, or some other very hard stone.

In the neighbourhood of Bienne, 'im Luterholz,' on an exposed eminence, there is a block weighing about twenty hundred-weight with eighteen hollows, of which eight are set in pairs, and six in rows of three joined together by furrows. A sketch of this stone has been kindly communicated by Colonel Schwab, and is drawn Plate XXXIX. fig. 14. Another

of these stones with hollows, drawn Fig. 13, was found in a grave opened on the height of Jolimont, between the lakes of Bienne and Neuchâtel; it is now in the collection of Colonel Schwab.

33 and 34. ESTAVAYER.—See page 156.

35. Below CORBIÈRE.—Distant from the land about 700 feet. Depth of water eight or nine feet. Extent about 58,000 square feet. A Roman water-jug was found here. The rocky shore, in which there are many hollows formed by the action of the water, bears the name of La Creuse, or 'Port des Sarrasins.'

36 and 37. FOREL.—Distant from the land about 880 feet. Depth of water from five to seven feet. This settlement is of later date. Roman tiles have been found here.

38 and 39. CHEVROUX.—Distant from the land about 400 feet. Depth of water from three to four feet. One of these settlements nearest the village is covered with sand, and has been built over by a harbour mole. The other may possibly form part of the same dwelling. Spindle-whorls of stone have been found here, and also the singular bronze dagger drawn Plate XXXIX. fig. 1. A remarkable bronze implement is drawn Plate XXII. figs. 20, 21, 22, 23, and 24. The use of it is unknown. As it has a socket, it appears to have been fixed on a staff or stick; the four rings on the rod joining the two sides of the metal strip are movable.

40. Above CHEVROUX.—Distant from the shore about 600 feet. Depth of water from five to eight feet. Extent about 58,000 square feet. The antiquities found are pottery, corn-crushers, stone celts, bronze sickles, knives, swords, and armlets, and a great iron fork.

41. GLETTERENS.—Distant from the land about 600 feet. Size about 77,000 square feet. The depth of water from seven to eight feet. This settlement is of later date. Fragments of earthen vessels and of Roman tiles have been found here.

42.

43. PORT ALBAN.—About 980 feet distant from the shore in a depth of five feet of water. Extent 87,000 square feet. The antiquities found here were pottery, stone chisels, and pieces of stag's horn. Between this place and Cudrefin, according to Professor Desor, there is a station of the iron age.

44. About 590 feet from the shore. Depth of water four feet. Extent 68,000 square feet. Stone spindle-whorls, stone celts, pottery, and pieces of stag's horn have been found here.

45. CHAMP MARTIN.—About 400 feet distant from the shore. The water is about four or five feet deep. There is here a

'Berg,' or elevation of the lake bottom. Probably this is an earlier settlement, but it has not yet been carefully examined; only clay spindle-whorls have been found as yet.

46.

47. Near CUDREFIN.—About 200 feet from land. The water is two feet deep. Extent about 77,000 square feet. There is a raised hillock to be seen here. The place is overgrown with weeds, and is partly dry when the water is low. The piles are numerous. Pottery has been found here, and a boat made out of a single stem.

48.

49. A LA SAUGE.—This settlement, the extent of which has not yet been ascertained, is situated above 980 feet from the land. The depth of water is about seven feet. The antiquities found here are pottery, among which is the specimen drawn Plate XXXIX. fig. 3, apparently a kind of funnel, Roman tiles, and the handle of a Roman amphora.

50. PONT DE LA THIÈLE (Zihlbrücke), between the two lakes.—This settlement is situated on the right bank of the river; it begins about 150 paces above the remains of a Roman bridge; it is continued under it, and terminates about twenty paces below. It touches the shore. The antiquities found here are stone celts in haftings of stag's horn, and also fragments of Roman pottery and tiles. The iron lance-head drawn Plate XLVII. fig. 7 was found about 3,000 feet above the Pont de la Thièle in the lake of Neuchâtel. In this locality piles are seen more than 3,000 feet from the shore. This lance-head is ornamented with raised lines and with furrows very similar to those on the iron fork from Möringen drawn Plate XL. fig. 3; the socket has on each side rather a sharp spike. Probably this weapon belongs to the series of iron implements, ornamented swords, &c., which have been found in the vicinity, and are described in this volume.

LAKE OF MORAT.

All the settlements discovered in this lake by Colonel Schwab are laid down in the map on Plate LVI. Repeated excavations have also lately been made at many points by Colonel Schwab, Baron von Bonstetten, and the Count de Pourtalès, the owner of an estate on the west shore of this lake, and the result has been the acquisition of many interesting specimens and of much valuable information. On the whole we may

remark that some of the stations, such as that part of Greng which is nearest the shore, belong exclusively to the stone age, while others, such as Montellier, were founded in the stone age, but continued till the bronze and iron periods. With respect to the character of the objects found at the last-named station, it is striking that the earthenware vessels, although made with the hand alone, yet show a certain skill in the workmanship, a great variety, and much elegance of form, all of which qualities are wanting in the corresponding objects from the bronze settlements of the lakes of Eastern Switzerland, such as those of Sempach and Ueberlingen. It is a remarkable fact that in that part of our country where the chief place, Aventicum, was situated, we should find proofs in prehistoric times of a very early advance in civilisation. If we possessed no other proof of the early progress of this district, the bronze die for the largest type of Gallic gold coins found some years since at Avenches would place the correctness of this observation beyond a doubt. (See the Archæological Journal for 1862, p. 253, and vol. xv. of the 'Transactions of the Zürich Association:' Dr. Meyer's 'Gallic Coins,' p. iv.)

The settlements are on both sides of the lake, and are nearly at regular distances apart.

1 is a large station with numerous piles, about 930 feet from the shore. The piles project two or three feet from the lake bottom.

2. MONTELLIER.—See page 190.

3. This settlement lies a little above the monument of the battle of Murten or Morat. It is about 1,080 feet from the land, and is of considerable extent. The piles are not visible.

4. Near GRENG.—See page 184.

5. A small settlement. Depth of the water from four to six feet.

6. A large settlement, but to the present time nothing has been found here but Roman tiles.

7 is like 6.

8. A small settlement in water three feet deep. No piles are visible.

9. A small station, apparently without piles; depth of the water three feet. Pottery is found here.

10. A small settlement. Between the stations 10 and 11 Colonel Schwab found about a hundred clay vessels, some perfect and some broken to pieces; several of them were prettily formed, and neatly ornamented; he also found what are called slingstones, corn-crushers, clay rings, and, lastly, a bronze

earring, and a bronze plate with traces of tinning like those found in the Gallo-Roman settlements. (Plate L. fig. 14.)

11 is situated somewhat farther off in the lake. No piles are visible.

12. A small place. Nothing has been found here as yet.

13. Rather a large settlement, but also without antiquities.

14. A small settlement. A stone celt, an iron javelin, and Roman tiles have been found here.

15 and 16. These places are covered with fifteen feet of water.

When the investigations were carried on in this lake, the water unfortunately was very muddy, and in many places, as for instance at Nos. 10 and 11, where most of the pottery was found, the bottom was covered with lake grass. To examine it completely, it would be necessary to employ a mud-machine.

Baron von Bonstetten, who has investigated this lake, and confirmed the observations made by Colonel Schwab, has drawn attention particularly to the problematical use of the conical settlements found in it. They bear the greatest resemblance to the sepulchral tumuli on land, and according to Colonel Schwab's report, the summit would only afford room for the erection of a single house. Towards the landside they are only two or three feet higher than the lake bottom, but towards the lake these little hills have a rapid slope of sixteen or eighteen feet; when the water is low, some of them project from the surface. They consist entirely of rubble and broken stones, and are quite circular at the base. M. von Bonstetten examined one of them carefully, and was unable to discover even a trace of piles, of pottery, or of anything formed artificially.

The stations which exhibit these artificial and conical elevations are Nos. 2, 3, 6, 8, 9, 10, 11, 12, and 14.

The richest place of the lake of Morat is near Guévaux (between 10 and 11); this is where the largest number of earthenware vessels are found, and where Colonel Schwab's dredger met with a piece of the clay covering of the huts resembling in height and curve a portion of a large pot. Here also was found the earthenware vessel drawn Plate L. fig. 15; it has the neck perforated with a row of holes one above another, each in a line running round the neck. These perforated vessels, it will be remembered, have been repeatedly found in other settlements, both in the lakes and on the mainland.

LAKE OF GENEVA.

The settlements on this lake, both on the northern and southern shores, have been discovered and investigated by M. Troyon, Professor Morlot, some antiquaries of Geneva, and especially by M. Forel, of Morges, President of the Historical Society of Western (Romanischen) Switzerland. It is to the last-named gentleman that we are indebted for an accurate account of the lake dwelling of Morges, one of the most extensive of these settlements, and also one which has afforded the greatest number of antiquities. He has established a very instructive museum of the antiquities discovered in the lake; amongst which will be found many remarkable bronze implements, and a great number of earthenware vessels equalling the best specimens of the potter's art of these early ages.

The settlements of this lake extend to a considerable depth into the water, and exhibit a firmer and better preserved substructure than those of the eastern lakes, which were founded and came to an end in what is called the stone period. This peculiarity of the pile villages of the lake of Geneva, together with the nature of the antiquities found in them, lead M. Troyon to the conjecture that beneath the remains of dwellings bearing the character of the bronze age those of the earliest stone age may possibly lie buried. The piles of the colonies in the lake of Geneva consist chiefly of stems of oak from three to eight inches thick; they are placed at various distances from the shore, and had been driven into the muddy bottom, where the water is from eight to twenty feet deep; even at the present day some of them project above the bottom five or six feet. They are placed from one to two feet apart, and sometimes more, but they form no regular lines, though as a whole they exhibit a certain kind of arrangement parallel with the shore.

The following is a list of the settlements on this lake so far as they are known.

1. Cully.
2. Lutry.
3. Pully.
4. Cour.
5. Vidy.
6. St. Sulpice.
7. Morges.—See page 194.
8. St. Prex.

9. ROLLE.

10. NYON.—Opposite the anchoring-ground between the harbour and the point of Promenthou.

11. VERSOIX.

12. PÂQUIS.

13. RIVE.

14. Opposite GENEVA.—The piles are to be found in different places at the end of what is called the little lake. Rows of piles are seen running sometimes straight and sometimes diagonally across the lake, and are known by the name of 'Travers.'

15. LA BELOTTE.

16. LA GABIULE.

17. BASSY.

18. HERMANCE.—At a distance from this place along the shore of Savoy, which may be accomplished by boat in about twenty-five minutes, there is the site of a lake dwelling. It is easily recognised by the number of oak piles (red oak) fixed in the lake bottom, as well as by the numerous fragments of pottery, which may be seen. Some beautiful bronze celts, sickles, and fibulæ have been dredged up here. See the 'Journal de Genève,' September 30, 1857.

19. BEAU REGARD.

20. NERNIER.

21. YVOIRE.

22. THONON.

23. EVIAN.

24. AMPHION.

LAKE OF LUISSEL, NEAR BEX.

The following notice of this place is taken from the account given by M. Troyon in the 'Anzeiger für Schweizerische Geschichte und Alterthumskunde,' 1858, No. 2. I do not hesitate to attribute to this kind of construction the 'find' which was made at the end of the last century in the little lake of Luissel, near Bex, where the beautiful lance-heads and three fine bronze swords were found, which are now preserved in the museums of Lausanne and Bern. An eye-witness of this discovery has assured me that in the same place pieces of wood, bones, and also some corn were found buried in the peat. An account of this discovery is to be found in the 'Nouvelliste Vaudois' of October 31, 1803. The date of the discovery was March 24, 1791, and it occurred in consequence of the works for draining and procuring the peat.

LAKE OF ANNECY.

Two lake dwellings have been discovered in this lake.—See the 'Bûlletin de l'Association Florimontane d'Annecy,' No. 5, p. 201, 1856.

LAKE OF BOURGET.—See page 202.

MERCURAGO AND BORGO TICINO.—See page 210.

SAN MARTINO AND TORRE BAIRO.—See page 215.

LAKE VARÈSE.—See page 217.

PESCHIERA AND THE LAKE OF GARDA.—See page 218.

LAGO DI FIMON, NEAR VICENZA.—See page 222.

TERRA MARA.—See page 222.

GENERAL REMARKS ON THE LAKE DWELLINGS.

After having taken a view of most of the lake dwellings which have been discovered in the Swiss district up to the present time; we hope that a few words respecting the nature of these settlements, the date of their existence, and the nationality of their founders, will not be considered unsuitable even if the discussion should end in mere conjecture.

No one who was present during the excavation at Meilen, the earliest settlement examined, and who saw the number of household utensils, the beds of charcoal ashes, the hearthstones, the pottery, the remains of wild animals which had served for food, and especially the 'relic-bed,' partly arising from the accumulation of this animal refuse, and limited to this very locality, has ever denied that on this very spot where the piles and so many products of human industry were found, there had once been a regular settlement, and that however much it may go contrary to our preconceived ideas of the lazy life of a hunting and fishing people, the mass of piles formed the foundation of their dwellings.

But though there was no doubt as to this general fact, another question arose and created much interest amongst the workmen as well as the bystanders, namely, whether the primitive race had lived here on level ground, on the dry though perhaps sandy and loamy banks; or whether we may conclude that the piles stood, as they now do, in the lake itself, but originally projected above the water even at its highest level, and that the huts of the settlers had been built on the tops of these piles as on a kind of bridge.

After so many lake dwellings have been examined, it may possibly be thought needless to enter into this question, as it is virtually set at rest. Still, as the first alternative has been brought forward, and it is possible that some persons may still adhere to it, there can be no harm in devoting a few lines to a consideration of it.

In the first place, it involves the somewhat venturesome, but often repeated, hypothesis that in early times the surface of the

lake of Zürich and that of most other Swiss lakes was lower than at present. In order to gain a foundation for this assertion, it is pointed out with reference to the Zürich lake that ever since the foundation of the city till comparatively a late period whatever earth was dug out for building purposes or for levelling the ground was at once thrown into the river, as well as all rubbish and sweepings, just as was the case in all the cities situated at the outlet of lakes. This, together with the encroachments of buildings and streets, had seriously altered the original width of the river-bed. As a direct proof that there has been a gradual elevation of the bed of the river, the fact is brought forward that when excavations are made a few feet deep in the bed of the Limmat, pottery, bones, implements of metal, and other things of the early ages are met with.

If, therefore, the lake having its outlet thus reduced was dammed or penned up in later times, and its surface a few thousand years ago was lower than at present, the settlers at Meilen, and similar erections, in driving such an immense number of piles would have intended nothing more than to secure a strip of land on the banks of the lake from any damage which might be caused by the waves, so that they might erect their abodes on the dry mainland and apply themselves to all the business of life in perfect safety.

According to the second view, with which, after having examined the piles in the lake of Bienne, and for many other reasons, we agree most entirely, the piles were from the commencement driven into the actual bed of the lake; and they were so long that their heads stood a few feet above the water, whatever might be its level.* They stood in close rows, and when covered with horizontal timbers and boards formed a firm scaffolding, a foundation for the erection of the dwellings themselves. These abodes were therefore like the fishermen's huts which were found in earlier times, and perhaps even now are to be seen, on several of the Swiss lakes. We know, indeed, very little as to the shape of these ancient huts, except that they were built of poles and hurdle-work, coated on the outside with clay, just as was the case at Ebersberg on the mainland, described towards the close of this volume. In or near the huts there was room enough for all the operations of daily life to be carried on, as well as the manufacture of every implement

* The difference between the highest and lowest level amounts to full eight feet.

used in household economy. Here they cooked, and here they spun; here clothes, string, and all manner of hunting and fishing-tackle were made; here serpentine, stag's horn, and bones of various animals were worked up into tools; here the pottery was manufactured. In short, this was the place where every craft or art known to the settlers was brought into play. All the refuse of wood, the remains of animals used for food, and useless or broken utensils were thrown into the water, and then they sank in the mud.

Probably the first idea of erecting this kind of pile-building may have arisen chiefly from the necessity of securing the lives and property of the colonists from the irruption of enemies.* The same reasons which led men in one place to settle on inaccessible heights, and to surround themselves with walls, induced a part of the earliest inhabitants of Switzerland to found dwellings in the lakes. On this account these strongholds were placed at some little distance from the land, and could with ease be defended against an enemy, who would have to advance either in boats or over a bridge. These lake dwellings cannot possibly be considered merely as places of refuge to be used in time of need, on account of the number of household utensils

* In the original report, printed some years ago, I stated my belief that the colonists, in erecting pile buildings in the lakes, wished to secure themselves from the irruption of enemies, and the attacks of wild beasts. A closer consideration of the subject has led me to modify my opinion. In an account of the lake dwellings by Professor von Hochstetter, printed in No. 51 of the 'Œstr. Zeitsch. f. Wissenschaft,' &c. p. 1613, the following paragraph occurs: 'This people must have had their chief settlements on land, and the lake dwellings must have been used for some special purpose. It does not appear to me that safety from wild beasts had anything to do with their erection; wild beasts avoid the human race, and even uncivilised man is nowhere in the world so helpless as to fly to the water for protection from ravenous animals.' Though I consider the first part of this assertion inadmissible, which refers to the actual use of these settlements, yet the view of this well-known naturalist, who had the opportunity of studying for a length of time the manners and customs of living races under exactly similar conditions, is worthy of all attention, and I have consequently again examined the grounds of the opinion I expressed with reference to security from wild beasts.

When we speak of ravenous beasts in the Alpine regions, we can only refer to bears, lynxes, and wolves; for no mention is made in history of any others, and these are the only animals of the kind whose remains are found either in the lake dwellings or buried in the soil. Now, I have searched in vain in the oldest written chronicles of our country for any instance in which a man has been seized by one of either of the two first-named animals; and with respect to the third, Conrad Gessner expressly declares that the wolf, so long as his usual sustenance does not fail him, will not venture to attack men; and Stumpf, who wrote in the middle of the sixteenth century, says that fewer wolves are found in the Alpine Mountains and Helvetia than in any other country of Europe, for if they came, as was probably the case, from Lombardy or the German countries, they would not be of frequent occurrence.

From this it appears that the idea must be abandoned which supposes that the lake dwellings were erected as a protection against wild animals.

found in them, and also from the existence of the 'relic-bed' which seems to indicate that these settlements lasted, and were actually inhabited, for a long period. Besides this, it is very evident that this particular kind of erection offered many advantages for both fishing and navigation.

With respect to the age of the *early* settlements of this nature we have not a single safe datum to guide our determination, so that it is quite impossible with any probability to decide even approximately the century or the centuries when they existed. The banks of lakes and river-valleys seem to have been the spots preferred by men in the early ages for permanent settlement, at first probably to support themselves by fishing and hunting, afterwards for their convenience as shepherds and tillers of the ground, and in still later times on account of the greater facility of intercourse.

But though we are unable to decide the age or ages when settlements such as Meilen existed, yet there can be no possible doubt that from the antiquities found there, even granting some degree of uncertainty as to the flint and stone implements (for they lasted in some cases through several periods) we are obliged to ascribe to them a very high antiquity.* We may venture to place them in an age when iron and bronze had been long known but had not come *into our districts* in such plenty as to be used for the common purposes of household life, at a time when amber had already taken its place as an ornament and had become an object of traffic. The fact that in the settlement at Meilen there were few bronze and no iron implements, while bronze is abundant and iron not rare in the settlements of the Bienne lake, may possibly be explained by the seclusion and poverty of the colonists at Meilen who lay beyond the reach of barter and possessed no materials for carrying on this trade. Very probably the same relations existed here as at the present

* The settlement at Meilen appears to belong to about the same period as the tumuli or barrows of South Dorsetshire, described in the Archæologia, vol. xxx. p. 327. 'The articles found in these barrows comprise urns of varied size and form, of coarse material and rude manipulation, implements of bone, beads of clay, flint arrow-heads, deer's antlers, and, but rarely, weapons and implements of bronze.' Also some tumuli in Wiltshire (Archæol. xv. 122, and Sir Richard Hoare's account) in which similar objects were found to those at Meilen, and the tumulus described by Ledebur at Malitschkendorf, in the province of Saxony (das Königl. Museum vaterländ. Alterth. im Schlosse Monbijou zu Berlin, 1838), in which, amongst other things, were found a number of boar's tusks, stag's horns, bones of domestic animals, besides pottery, a spindle-whorl, battle-axes, mealing stones, weights for nets; and further, awls, needles, styles, and arrow-heads, the whole of which were made out of the horns and bones of the stag.

day in Western North America and several other countries whose inhabitants can by barter obtain the necessary instruments of metal, but yet are compelled to employ for their common household purposes those materials which are afforded to them in such abundance by the animal, the vegetable, and the mineral kingdoms.

As a similar state of civilisation always calls for similar wants, and these again for similar means to supply them, and consequently similar utensils for the different purposes of life, we shall be able to gain the clearest idea of the civilisation of the colony of Meilen and other settlements of a like age, if we compare the products of their industry and the ideas we have consequently formed of their culture with the accounts given by those travellers who in the last and present century have visited nations beyond the reach of European civilisation, and who spent their existence under similar conditions of life. The picture we have given of the settlers of these early colonies from the antiquities found in their ruins, resembles in a striking manner that which Captain Cook gives us of the inhabitants of New Zealand, which he visited in the year 1770. We venture on giving the following extract from his work:—

'Having said thus much of the workmanship of the New Zealanders I shall now give some account of their tools. They have adzes, axes, and chisels which serve them also as augers for the boring of holes. As they have no metal, their adzes and axes are made of a hard black stone or of a green talc which is not only hard but tough, and their chisels of human bones or small fragments of jasper which they chip off from a block in sharp angular pieces like a gun-flint. Their axes they value above all that they possess, and never would part with one of them, for anything that we could give. I once offered one of the best axes I had in the ship, besides a number of other things, for one of them, but the owner would not sell it, from which I conclude that good ones are scarce amongst them. Their small tools of jasper, which are used for finishing their nicest work, they use till they are blunt, and then, as they have no means of sharpening them, throw them away. We had given the people at Tolaga a piece of glass, and in a short time they found means to drill a hole through it, in order to hang it round the neck as an ornament by a thread, and we imagine the tool must have been a piece of this jasper. How they bring their large tools first to an edge, and sharpen the weapon which they call Patoo-Patoo,

we could not certainly learn, but probably it is by bruising the same substance to powder and with this grinding two pieces against each other.' ('Hawkesworth's Voyages,' vol. iii. p. 395.)

To this extract we may add a few more particulars taken from the same work. The New Zealanders make all kinds of twine fishing-tackle and cord out of the leaves and fibres of the New Zealand flag, a vegetable which grows there in abundance and serves them instead of flax. They wear on cords all kinds of ornaments, such as chisels and awls, or 'bodkins made of green talc, upon which they set a high value, the nails and teeth of their deceased relations, the teeth of dogs, and everything else that they can get which they think either curious or valuable. The women also wear bracelets and anklets made of the bones of birds, shells, or any other substances which they can perforate and string upon a thread. They carry on weaving and other peaceful arts. Their houses are the most inartificially made of anything among them; they are seldom more than 18 or 20 feet long, 8 or 10 broad, and 5 or 6 high from the pole that runs from one end to the other and forms the ridge to the ground; their framing is of wood, generally slender sticks, and both walls and roof consist of dry grass and hay, which it must be confessed is very tightly put together, and some are also lined with the bark of trees, so that in cold weather they must afford a very comfortable retreat. The roof is sloping like those of our barns, and the door is at one end just high enough to admit a man creeping upon his hands and knees; near the door is a square hole which serves the double purpose of window and chimney, for the fireplace is at that end nearly in the middle between the two sides. That part of the floor which is allotted for the fireplace is enclosed in a hollow square by partitions either of wood or stone, and in the middle of it the fire is kindled.'

'Their household implements and tools are few in number; their largest boats consist of boards bound together; the smaller ones are merely one trunk hollowed out by fire. Their fishing-hooks are made either out of bone or shells. They have spears and javelins, some of which are pointed with bone, but they chiefly rely on the Patoo-Patoo, which is a kind of club made either of green talc or some very large bone, shaped somewhat like a pointed battledore with a short handle and sharp edges, admirably fitted for close fighting, and such as would certainly split the thickest skull at a single blow; the handle has a hole bored through it, and they wear it fastened to the wrist with a

strong thong.* Their agriculture is very simple; the ground is merely turned up very carefully by a sharpened stake with a short cross piece attached for the convenience of pressing it down by the foot.'

Let us now endeavour, by comparing the facts which have come before us when investigating the remains of the lake dwellings, to draw a picture of the manner of life and industrial activity of these very ancient inhabitants of Switzerland and the neighbouring districts.

The settlers appear to have considered a sunny shore in some measure protected by hills and promontories from storms and the action of the waves, as a peculiarly favourable locality for erections of this nature. A pleasant bay, opening to the south at the foot of well wooded hills abounding in game must have been thought particularly inviting. But as even the earliest settlers were not only fishermen and hunters but also shepherds and agriculturists, as may be proved by the remains of domestic animals and the stores of grain found in the ruins of their dwellings, we may conclude that the neighbourhood of good pastures and tillage land materially influenced them in choosing the sites for their habitations. A second indispensable requisite was a lake shore tolerably broad but not very deep, chiefly composed of what is called in Switzerland 'weiss-grund,' 'blanc-fond,' and in English shell-marl, so that piles driven into the lake-bottom might project a few feet above the surface even at its highest level. The ground must necessarily have been of a muddy or gravelly nature, for piles could not have been driven in where the locality was rocky. According to the slope of the shore and the extent of the shell-marl, the lake dwelling was placed farther from or nearer to the land, frequently however so close to it that access might be obtained by a bridge or stage from two to three fathoms long. The piles which were used for the substructure of these dwellings were straight stems, from 4 to 8 inches thick, of the kinds of wood growing in the neighbouring forests, viz. oak, beech, fir, pine, and birch. The trees having been felled either by means of fire or with the stone hatchet were used either whole or split, some with the bark on, some peeled; and in order to facilitate the driving they were sharpened at the lower end either by fire or by the stone axe above referred to. The pile-driving, which necessitated the use

* This remark explains the occurrence of holes in the handles of many kinds of bronze weapons in the lake dwellings.

of a raft, was effected by means of heavy stones and ponderous mallets, many of which have been found. There can be no doubt that the piles were placed, not at random, but according to a regularly arranged plan, and as there is hardly a case in which the superstructure of any of these dwellings yet remains, so in like manner the original arrangement of the piles can very seldom be made out. They appear above the lake-bottom like the remains of a forest snapped off by a storm or destroyed by an avalanche. When the piling was finished, which of course was of greater or less extent according to the number of the colonists, the outermost piles, at least in some cases, either to prevent the splashing of the water under the future abodes, or for the sake of catching fish, were securely wattled together with twigs. Then came the equally difficult and laborious task of making the platform on which the huts were to stand, and which had also to be large enough to carry on many different operations. To accomplish this, stems or trunks 10 or 12 feet long had holes bored in them at both ends, and they were then fastened with wooden pins on to the heads of the upright piles which had been previously brought to a level. Trunks of fir-wood 5 or 6 feet long were then split into boards about 2 inches thick and fastened with wooden pegs into the framework, and thus formed a solid even platform.

The great number of objects lying scattered on the bed of the lake, which had slipped through the chinks, show how imperfectly the boards and planks fitted together, over the piles. Again, the quantity of broken stone celts, broken pottery, and refuse of animal and vegetable food lying together show that there were spaces intentionally left in the platform. With respect to the shape and condition of the huts, we can hardly give any positive idea, as in most cases these parts of the dwellings have been destroyed by fire. So far is certain, that the walls consisted of upright poles, wattled with rods or twigs; and in order to keep off the wind and the rain, this wattlework was covered both inside and outside with a bed of clay from 2 to 3 inches thick. There can be no doubt that the huts of several kindred races on the mainland were in many cases circular;* but all the evidence we possess as yet, respecting the huts of the lake dwellings in Switzerland, tends to show that they were rectangular. The curve of the small pieces of clay covering of

* Strabo, iv. 4.—The Belgian Gauls make their huts spacious, out of boards and willow hurdle-work, domeshaped with a high roof.

the wattle-work found at the bottom of the water cannot be brought forward to prove that the huts were circular, still less to show their diameter; these pieces are generally not more than 1 foot wide, and have evidently been exposed to great heat before they fell into the water; besides which, slabs with very different curves and some even perfectly flat were found promiscuously on the same spot. Clay was also spread out on the floor inside the huts, in some cases mixed with gravel, forming a kind of plaster floor and filling up the chinks. In the middle of the hut was a hearth made of slabs of rough sandstone. The roof consisted doubtless of the bark of trees, straw, and rushes, the remains of which have in many cases been preserved in the mud. It is impossible to ascertain whether the platform was covered densely or sparingly with huts, though we know that in one case, at Niederwyl, they stood very close together. We have only lately ascertained that the cattle, as appears to have been the case with the Pæonians, by the accounts of Herodotus, were brought here for shelter and regularly stalled in these lake dwellings.

The occupations of the settlers were of many various kinds, and may be divided according to the different modes of procuring sustenance into the operations of fishing and hunting, pasturage and agriculture.

The large number of skeletons of fish which had been used for food, and especially the skulls of very large pike which are found buried amongst the piles, are a proof that fishing was carried on very successfully. In some of the earliest settlements the actual fishing-nets and hooks made of boars' tusks have been found. And if we look at the implements used for taking fish by the uncivilised races of North America and the South Sea Islanders, we may venture to assume that the lake dwellers also relied on darts and javelins for catching the fish which abound in the Swiss lakes. Some of the points made out of bones of birds and small animals, frequently barbed, remind us forcibly of the fishing implements of these nations.*

The chase of game in the forests was no less productive. If we read the accounts given in ancient writings† of the great

* According to Diodorus Siculus, iii. 15, the Ichthyophagi, amongst the Ethiopians, catch fishes and seals without any artificial weapons; they merely strike them with bucks'-horns. Everywhere, he says, necessity teaches man to find out the means of attaining any particular point in his own condition of life.

† See Benedictiones ad mensas, in vol. iii. of our Transactions, translated into English by W. M. Wylie, Esq., M.A., F.S.A., and published in the Journal of the Archæol. Institute for 1865. Also the old chronicle 'Gessner's Thierbuch,' &c.

quantity of game of all sorts, and the number of rapacious beasts such as bears, lynxes, and wolves which lived in the forests and deep mountain valleys, we can form some idea of the abundance of animals of the chase which ranged over the land when the country was still covered with the primeval forest and the scattered population was still unprovided with adequate weapons of the chase. The bones which lie about in the lake dwellings in astonishing numbers, of stags, roes, wild-boars, beavers, otters, squirrels, and other animals, are an evidence of the abundance of game, and of the ability of the settlers to bring down even the higher descriptions of wild animals. There are many proofs also that the urus and also beasts of prey, such as the bear and the wolf, were not safe from their clubs and javelins. At all events the products of the chase formed no inconsiderable portion of their subsistence.*

It has been well observed by Professor Rütimeyer that 'the lake dweller lived in a certain manner like an islander in the middle of a rich world of animals at enmity with him. If the domestic cattle and hunting provided him with meat, yet there was no superfluity, for it is a general peculiarity of the refuse of their kitchens that all the bones which contained marrow, or anything eatable, had been carefully hunted over for this miserable pittance. All the bones with marrow, and especially the long bones of the extremities, have been opened lengthwise, and in the skulls where the inner pulp of the teeth and the surrounding cellular tissue may be expected in the jaws, these parts, without exception, have been opened with a readiness which by constant use had almost become art.'

One circumstance of the highest interest in studying the grade of civilisation possessed by the lake dwellers, is that they were not ignorant of the art of keeping cattle, and consequently had already made the first steps towards civilised life. In fact, the possibility of so many people living together as could be lodged in a settlement of the size of those of Wangen or Robenhausen can only be explained by the population depending, not solely on the chance produce of hunting and fishing, but also on cow-keeping, which would provide the necessary subsistence at all times of the year. The investigation of the bones which are found in such great numbers amongst the piles of all the lake dwellings has shown that, together with the remains of the beasts

* Perhaps the aurochs, the urus, and other wild animals, were taken in the manner now made use of in America, where deep pits are excavated and covered with branches

of the chase, those of the domestic animals are met with, especially of the dog, which even in the oldest settlements is found as man's companion, and moreover of cows, sheep, goats, and pigs. This fact changes the ideas which on a superficial view of these abodes, constructed so strangely and with such primitive mechanical means, we may have formed of the condition of their builders, and obliges us to place their grade of civilisation much higher. The attendance upon cattle presupposes the knowledge of many arrangements—a regulated continuous activity, and a care for the future, qualities which are not to be found in the mere hunter.

This multifarious activity rendered necessary a division of labour; for the individuals who looked after the cattle, led them to pasturage, protected them from the attacks of wild beasts, and stored up dried grass and winter food for the different kinds of animals, could not possibly occupy themselves also with the chase or the manufacture of tools. The domestic economy, therefore, of those colonists, whom we know to have been also shepherds, may be considered in a more favourable light, and shows that their condition must have been a more tolerable existence than at first sight one would have imagined.

Besides this, in every lake dwelling are to be found stones for bruising and grinding grain, or what are called corn-crushers and mealing stones; the very grain itself has been found at Meilen, Moosseedorf, and Wangen, nay, even the very loaves or cakes in their original form; and we therefore recognise the colonists as agriculturists, and see them advanced to a grade of civilisation when men formed permanent abodes, and secured for themselves a peaceful neighbourhood and social order. The tilling of the ground must indeed have been simple in the highest degree, and have consisted merely in tearing it up by the means of inefficient tools made of stags' horns (see Plate XCIV. fig. 3) or with crooked branches of trees, as is now done in North America. But the products obtained by imperfect tillage from the cultivated ground, which would have to be enclosed by hedges as a protection against wild animals, are of a quality which is not surpassed by the best of the present day.

As Professor Heer has favoured us with some remarks on the

of trees. The animals which had fallen into one of these pits, and which the colonists with their imperfect weapons would otherwise be unable to overpower, might now be despatched with stones; we have no doubt that some of what are called 'Mardellen' or 'Kesselgruben' (see vol. vii. No. 7 of our Transactions) may be considered as pits for catching wild animals.

husbandry of the inhabitants of the lake dwellings, which will be printed hereafter, it will only be necessary here to give a few more particulars as to the kinds of corn hitherto discovered: they are wheat, and the barley with two rowed ears, which at the present day is cultivated in the east. Barley and wheat are, in fact, those cereals which are well known to have been cultivated in the east of Europe, whence the original immigration of the human race came westward. Herodotus, iv. 17, 18, 33, 53, expressly states that the culture of wheat was carried on in the southern part of Scythia, and that corn was an article of trade with the population of that district.

The settlers also cultivated flax of excellent quality, the care and preparation of which required great attention and skill of various kinds; it was spun into threads by means of spindle-whorls, and platted or woven into mats and coverings. The early use of the loom in the countries just mentioned is affirmed by Herodotus, book ii. 105, iv. 74. As the industrial arts connected with flax and other vegetable fibre, as well as the preparation of the skins of beasts, are of considerable importance, a special chapter is devoted to them in a subsequent part of this volume.

A great deal of time would probably be occupied by the manufacture of implements for domestic purposes, for the chase, and for fishing, as well as of the tools themselves. As we have already remarked that the multifarious activity in these colonies may have required a division of labour, this idea is forced upon us anew if we examine the great variety of tools used by the settlers. In illustration of such a division of society, the following extract from Schoolcraft on the primeval inhabitants of Florida and North America may be of interest. It is taken from his work 'History, Condition, and Prospects of the Indian Tribes of the United States,' iii. 75. He says: 'It is very clear that the art of the potter with these races was a "fixed art," and the occupation of a particular class of this people. A hunter or a warrior could not lay aside his bow or his club and set to work to make pottery. The art of mixing clay with gravel,* so that the vessel does not change its form in burning, and bears a sudden transition from heat to cold, and *vice versâ*, presupposes, when successfully carried on, uncommon practice and long experience. Much less could the gene-

* The clay vessels of these people agree in a remarkable manner and most completely with those found in the lake dwellings so far as the material is concerned.

ral population manufacture flint implements of really good quality. Splitting the flints and making the fragments into the shape of lance and arrow-heads, knives, and saws requires extraordinary ability and long practice. Amongst the primeval inhabitants of North America there was a peculiar class of people whose business it was to select the suitable stones, and to manufacture arrow-heads, and who received from the hunters flesh and skins in payment for the implements supplied to them.'

As at the present day steel is the material to which either directly or indirectly nearly every implement owes its form, so, if we take a view of the manufacturing arrangements of the lake colonists, we shall be convinced that flint was the substance by which nearly all their instruments, whether of stone, wood, or bone, took the required form. By means of flints the stone hatchets or celts were worked out of the rough, and the bones sawn into piercers and arrow-heads, and thus it was the means of originating the tools required for the erection of the dwellings and the weapons of the chase. As metals were entirely wanting, unless this kind of stone had been procurable, we can hardly imagine the erection of the lake settlements, or even the very existence of men in the Swiss districts. And yet it was by no means the most abundant of those stones which were used for handicraft tools, and it was never worked in Switzerland to such an extent as in Denmark, England, and France. The reason is simply this: flint is found but sparingly in Switzerland, in the range of the Jura, and it occurs also in small masses, not fit, even if the workmen had the required skill, to make the larger tools, or any of the implements and weapons which occur in the north and are so justly admired. Instead of flint, other hard stones were used which were found in plenty and answered the purpose not only of splitting but also of sawing and grinding down, so that more patience was required than skill.

Amongst the stone implements the celts and chisels were by far the most abundant amongst the lake dwellings, and were used for many various purposes. They were manufactured in the following manner: in the first place a selection was made from the rolled or rubble stones abounding in the Swiss valleys; those being chosen which were hard and also tough. There is such an infinite variety amongst these stones, that it is difficult even for an advanced geologist to make out with certainty their original locality and nature. The celts found at the lake of Bienne, at Berne, at Zürich, and at the lake of Constance, form

quite as good a collection of specimens of the rocks of the high Alps, from which the different valleys descend, as the 'erratic blocks' used for building the castle towers and the city walls. To make the most important tool, the hatchet or celt, a rolled stone was partially sawn through on opposite sides by means of flint saws, used with water and quartzose sand; it was then broken in two by a blow. After this operation came the still more laborious affair of finishing the tools by strokes of stone hammers, and grinding it on slabs of sandstone. By a similar process the corn-crushers and beating stones, or stone hammers, received their form; a coarser sandstone was always selected for these instruments.

The flint used for saws, for arrow and spear-points came partly from the Swiss Jura, and partly from France and Germany. The instruments for working the flint, probably consisting of the same material, have never yet been found, or at any rate recognised;* and yet it is probable, nay, almost certain, that many flint implements were actually made in some of the lake dwellings, as, for instance, those of the lake of Constance. Flint hatchets are never found with us, and in general the flint implements of Switzerland bear no comparison either in variety of form or in the grinding and polishing of the work, with those found in the northern countries of Europe.†

* I have in vain searched in the reports of Schoolcraft (Smithsonian Institution) and in many other books of travels for an account of any possible way in which the wild races of America manage to make their spear and lance-points of flint and obsidian merely by some pieces of the same stone and without the use of any metal. Even the people who work the common flints as a trade can give no sort of idea how the ancient flint implements were made without metal tools, especially those from Scandinavia which are so artificially formed.

[*Flakes* of obsidian were made in Mexico, and those of chert by the Esquimaux, simply by strong pressure. See Sir John Lubbock's very interesting work, 'Prehistoric Times,' pp. 77, 78, and 79.—Tr.]

† With the exception of the flint hatchet or celt which, as above mentioned, is not found in Switzerland, the objects found in our oldest lake dwellings agree entirely with those of the oyster heaps (Kjökkenmöddinger) of Denmark, which according to Worsaae, in the 'Athenæum,' No. 1,679, December 31, 1859, p. 889, contain 'broken bones of stags, deer, bos urus, beaver, wild boar, &c., together with charcoal ashes, burnt stones, pieces of very coarse pottery, rude hatchets, spear-heads, knives, arrow-heads, flakes or chips, chipping-blocks, &c., of flint; a sort of hatchet or hammer made of stag's horn, different implements of bone, and very simple ornaments of the same material. Lake dwellings have also been discovered in the Lake Maribo in the island of Laaland like those of Switzerland to which (on what grounds we know not) a greater antiquity is ascribed. From the fact of the flint implements of the oyster heaps having been made quite roughly, neither ground nor polished, and very similar to those found in different bone caves of England and France, and in the gravel beds of Abbeville and Amiens, Worsaae concludes that the oyster heaps belong to an earlier period than the great stone chambers and cromlechs, and probably are to be ascribed to a peculiar wild race,

We have now to draw attention to a kind of stone which in all probability was an object of barter, viz. nephrite; it is found in all the older settlements, and most plentifully at Meilen. Though there may be some small amount of doubt still remaining, yet mineralogists assure us that it is not met with in Europe, but in Egypt, in China, and other parts of Asia. If so, it follows that even at the period of the earliest lake dwellings there was a traffic between the west of Europe and the countries of the east. The objects found in the tumuli which are identical seem to bear out this view. If we do not mistake, the nephrite, which was the mineral most valued for celts or hatchets, was imported already worked. The fragments of a broken implement were again ground and brought into use, but no unworked mass of nephrite has yet been found in the lake dwellings. We have already expressed our opinion in the account of Robenhausen that its inhabitants did not bring nephrite with them, but only received this valuable mineral after a sojourn of centuries in this locality. If so this can only have happened by barter.

The glass bead also found in the very early settlement of Wauwyl serves to indicate a trade by sea either with the Phœnicians or the Egyptians, as mentioned in the account of the above lake dwelling.

The different kinds of flint originally derived from distant parts of France and Germany, which are worked up into knives, arrow-heads, and other implements,* seem also to indicate that the colonists had a barter-trade to the north and west; and, the piece of amber found at Meilen apparently points in the same direction, though it is very occasionally found in Switzerland on the shores of the lake of Constance.

The bones of small animals and birds were used for pointed tools, spatulæ, chisels, and spear-points, and the larger instru-

the actual aborigines of Western and Northern Europe, who in later times were destroyed by a more powerful and somewhat more civilised people, the builders of the cromlechs and the makers of the beautifully formed flint implements. While the author places the oyster heaps of Denmark chronologically, or rather in the history of civilisation, on the same footing as the deposits first named in England and France, from which deductions have been drawn that man lived at the same time as the elephant, the rhinoceros, and other extinct animals; he divides the stone age into two periods, and the oyster heaps are considered to belong to the first. See also 'Prehistoric Times,' pp. 191 and 192.

* Herodotus, vii. 69, says of the Ethiopians in the army of Xerxes, 'they had sharp arrows made of reeds, and pointed, instead of iron, with a kind of stone used to engrave their seals. They had also spears, the points of which were roe's horns sharpened, like lance-heads, and they also carried knotty clubs.'

ments were made out of the ribs and the leg-bones of the roe and the stag, and the ulnæ of various ruminants. The hollow bones of these animals were cut into two parts lengthways by means of flint saws, generally along the arterial hollow, and thus when the fracture was fortunate each piece had an articulating end for a natural handle. The tool was then finished by means of the grinding slab of stone.*

Next to bone, horns, especially those of the stag and the roe, offered suitable material for making the larger pointed tools, daggers, &c.† The ends cut off from the main branch were sharpened on the grinding stone, and sometimes also perforated at the thicker end so as to be more conveniently worn or suspended. It is very singular that hitherto no implements have been observed, made out of the horns of the ox, the goat, or the ram, and yet their bones are found in the dwellings. The tusks of the wild boar seem to have been especially chosen for cutting tools; those of bears or wolves for amulets.

With respect to wood, it was used in the first place in the shape of piles and boards to build the dwellings themselves. Mallets and clubs were also made of branches which had grown in a wen-like form. Many small implements for domestic purposes were made out of wood. Large trunks of oak were hollowed out, either by fire or the stone celts, and used for canoes, and oak poles were used for spear shafts.

Bast or the vegetable fibre of different shrubs was made into ropes and lines.

The earthenware vessels deserve a closer consideration; they are found in great abundance, but unfortunately chiefly in fragments. These vessels have probably been worked into shape in the lake habitations, but burnt on the mainland. The whole of the pottery may be divided into two classes according to the nature of the material, one a coarser sort made of clay, mixed with a large quantity of grains of stone, and a finer kind made

* The following extract from the 'Travels in Peru and India,' by Clements R. Markham, Esq., London, 1862, p. 159, will show the use of bone weapons amongst the wild tribes at a late date, even long after they had become acquainted with European civilisation. It relates to the insurrection of the Inca Tupac Amaru, and the battle of Mananchili. 'The Indians left 370 killed on the field, among whom there were many women, who came to fight by the sides of their husbands and brothers, armed with *bones sharpened at one end*.'—[Tr.]

† With respect to the use of flint flakes, my attention has been called by my friend, the Rev. C. W. King, to the fact that the Mexican natives at the time of the conquest, according to Prescott, i. 107, carved 'the various stones and alabasters employed in the construction of their public works and principal dwellings with tools of obsidian, although they possessed bronze implements at the time.'—[Tr.]

of washed loam, in some cases mixed with a small quantity of charcoal powder. The shape of the vessels in the older settlements does not vary to any great extent. Urns with a large bulge and thin sides are rare; very few flat vessels are found in the shape of plates; as a general rule the form approaches that of a cylinder. With respect to the ornamentation, which even the most uncivilised nations seem compelled as it were by nature to use in making their utensils, it consists only of bosses or impressions made either with the finger or a little stick. On some specimens, worked with greater care, a commencement of the zigzag ornaments may be seen; and some also are painted with graphite and ruddle. It is very certain that many of the large pots were used for cooking, for they are covered on the outside with soot. The thick crust on the inside of these vessels was caused, as I am perfectly convinced, generally by the burnt remains of a mass of corn-pottage which adhered to the sides of the vessel when the settlement was destroyed by fire.

We may conclude that the clothes of the colonists consisted partly of the hides and skins of wild and tame animals, more or less prepared. As it is certain that they had sheep, their skins would form the best clothing for the cold season. Flax, both platted and woven, also formed some part of their garments, as is clearly indicated by numerous specimens lately found.

The provisions of the settlers of the lake dwellings, judging from what has been already said, consisted partly of animal food, such as the flesh of wild or domestic animals, fish, and milk; and partly of vegetable materials, amongst which corn-meal, either boiled or baked, took the chief place. The fruit also of trees and shrubs growing wild was not despised, such as crabs and wild pears, sloes, hazel-nuts, and especially raspberries and blackberries. Remains of all these fruits have been found in large quantities at Wangen.

We will hereafter lay before the reader some conjectures as to the religious notions of the lake dwellers when the figures of the crescent moon are described, which we recognise as objects of worship. A special chapter will be devoted to them, as the subject is of importance; but it will necessarily be a short one as there is really not much to communicate.

How the colonists buried their dead is as yet hidden in perfect darkness, for up to the present time no burying-place has been discovered in the neighbourhood of a lake dwelling.

The preceding remarks have applied chiefly to those lake dwellings the characteristics of which belong to the earliest age,

or what is called the stone period. This most primitive mode of living came to an end either before or about the time when a new material came into use, much more adapted for tools and weapons than stone. This was bronze, or a mixture of copper and tin, which, by a very simple operation, could easily be made into any required form, and which, as an article of trade, now began to be known in the Swiss districts. The exact point of time when this event happened, so important in the history of civilisation in Western Europe, and which contributed to the transformation and elevation of the physical condition of nations no less than the subsequent introduction of iron, cannot now be determined, even approximately, from the entire want of every chronological datum. Although the earliest inhabitants of these countries—the Celts, when they were first known to the Greeks and Romans, appear to have been well provided with bronze, and to have shown no common skill in managing the latter metal, as exhibited in the products of their foundries, lately brought to light, as well as those deposited in graves and tumuli, yet no author has ever mentioned—what could hardly have been passed by in silence—that they made use in war of bronze swords,* daggers, and spears, such as we see in our museums; and consequently the general use of these weapons must be thrown back into prehistoric times, and the first introduction of this material to an early part of the same period.

When once bronze had become general as a material for tools, and had gained a footing amongst the inhabitants of these settlements; † when the bronze celt was originally made just like the stone celt,‡ the new material must have asserted its influence on the lake dwellings, and on the arrangements and manner of life of the colonists. By means of these improved tools the wood could be squared and the whole building completed with much less trouble: larger oak trunks could now be

* It is much to be regretted that our best classical scholars will persist in translating χαλκὸς *brass*, when in at least nine cases out of ten it means bronze. The union of copper and zinc (the component parts of brass) was hardly known in ancient times, while that of copper and tin, in the shape of bronze, was universally known for ages. It is said that the lexicons give the interpretation brass; but if this is incorrect, why follow the lexicographers, and perpetuate an error?—[Tr.]

† A bronze mould for casting bronze celts has been discovered by M. Forel in the lake dwelling of Morges; hence it appears that one of the occupations of its inhabitants was bronze-casting, and doubtless the large number of bronze implements found there were manufactured on the spot.

‡ See Schreiber's 'Bronze Battle-axe.' It is quite certain that the stone celt, on account of its cheapness, continued in use till the iron age, and even till the early middle ages.

made use of, and by a more advanced state of mechanical science deeper places in the 'weisser Grund' or shell-marl could now be made available for the settlements. This is especially the case in the lakes of Geneva and Neuchâtel, where there are several instances of settlements of two distinct ages in the same place, those of the bronze age being further from the shore and in deeper water. An increased supply of bronze allowed all implements used for handicraft, for war, for agriculture, and for domestic purposes, to be made out of this material, such as swords, spear and lance-points, daggers, knives, sickles, and even personal ornaments. Everything formerly made of stone and bone now consisted of bronze, and in many cases were actual copies of the earlier tools; and we find the whole series of bronze tools from native foundries * spread before us in great abundance and variety from the sites of the lake dwellings; only single specimens had hitherto been obtained from the graves or tumuli, or picked up by chance in the fields. On all these objects, but especially on the rings, lance-points, daggers, and knives, the ornamentation called Celtic was lavishly applied.

Contemporaneous with the perfection of bronze-casting, and the general use of implements of this material, very considerable advances were made in other handicraft arts, especially in pottery. To this period, though the use of the potter's wheel was as yet unknown, may be ascribed that great abundance of earthenware vessels, which in their shape show no small skill in the potter's art, and indicate a correct feeling in the workmen as to fitness and elegance, and which were finished by being painted black or red, and by the line ornaments before mentioned. Still at this period no vessels are found artificially formed with long narrow necks, like bottles, flasks, or jugs, which are so abundant in Roman times. On this account, the grade of perfection in the potter's art, amongst the lake dwellers, and, in fact, generally amongst the pre-Roman inhabitants of Switzerland, must take a somewhat lower stand.

When the settlers had become fully acquainted with bronze, and had learned to work it, the implements of the former period gradually went out of use, so that in settlements founded

* In the year 1822 the owner of the manufactory at Wülflingen, near Winterthur, when digging deep in the ground to make a reservoir, found a space enclosed with sandstone filled with remains of fuel, and which proved to have been a bronze foundry. The walls had been burnt as in a furnace. Within it and near to it was found a quantity of bronze, by one account ten to twelve, and by another thirty cwts. in weight, partly in lumps and partly made into slabs, hatchets, swords, daggers, and pins. (See Gerold Meyer von Knonau, 'The Canton of Zürich,' vol. i. p. 66.)

in the bronze age, like Morges, stone and bone implements are just as rare as bronze objects are in many of the dwellings of north and east Switzerland, which were destroyed or abandoned in the stone age. Still the number of settlements is considerable which belong to both periods, and in which the implements of both ages are found mixed together.

At some period after the introduction of bronze, the date of which cannot now be determined, but which yet falls under the prehistoric age, iron appears, probably at first very sparingly, and as an uncommonly valuable material: from the total absence of metallurgic knowledge, the reduction of this metal from the ore must have been exceedingly difficult. In the Swiss district, where, without any doubt, there was no iron-mining, either in pre-Roman or in Roman times, this most excellent of metals, as Pliny calls it, was procured by barter.*

As soon as iron became known to the settlers, their first endeavours were exerted to make the instrument most necessary to them, the axe or celt, out of this material; then other iron implements took the place of bronze, and differed from them in design and form as little as possible. Weapons and all household and agricultural implements, which formerly were made at the bronze foundry, were now prepared by the smith out of this most useful of all substances extant.

It is further a matter of the highest interest, in studying these lake dwellings, to find that from the nature of the objects found in their ruins, the existence of many of them continued not only to the time when bronze was superseded by iron, but also extended into historic times. The discovery of Roman tiles, which probably were used, not so much for roofing, but, as is frequently the case in Roman buildings, for making the hypocausts, and for many other purposes, affords the most convincing proof that many lake dwellings still remained occupied when the inhabitants of Switzerland were known in history under the name of Helvetii, and were actually under the Roman

* See the article 'The Iron Lumps in the Swiss Collections of Antiquities,' 'Anzeiger für Schweiz, Geschichte und Alterthumskunde,' 1858, Heft 3, in which I have brought forward the opinion that the pieces of iron found occasionally of the shape of a double pyramid, and weighing about twelve pounds, may have been the iron prepared for sale in the earliest times; these lumps or pigs are fully described in the Archæological Journal, vol. xvi. p. 200; they are not found near any Roman site. Within the last few years several remains of ancient iron foundries have been discovered in the northern part of the canton of Berne (see the 'Recherches sur les anciennes Forges du Jura Bernois, par A. Quiquerez, 1866.) Respecting the gradual disappearance of bronze, see V. Bonstetten's 'Recueil,' p. 11.

sway. A great number of things, such as weapons, implements and ornaments of many different kinds, which are constantly met with amongst the ruins of the lake dwellings, and of precisely the same form also in tumuli, mark in a characteristic manner both the Helvetian and the subsequent Gallo-Roman periods.

No difference whatever is to be discovered in the construction of the lake dwellings, between those of the earliest and those of the latest age. The fact that the erections of the transition and bronze ages were built more substantially, and in deeper parts of the lake, may be explained by the use of better tools.

There is no ground for concluding that successive peoples of different races or civilisation have occupied these lake dwellings, one of which had chased the other from its abodes, in order to occupy them themselves, precisely in the same manner as the previous inhabitants.

The following facts respecting the origin and the duration of the lake dwellings result from the investigations hitherto carried on. The oldest settlements of this kind, especially those in the lakes of east Switzerland, had their origin in that dark time when, at least in these districts, the use of metals was yet unknown. Of these settlements, a part had been destroyed either before or in the course of the bronze period, while another portion, as is shown by the numerous lake dwellings of the western lakes, were in their most flourishing condition precisely at the same period. This singular mode of settlement lasted the longest in the lakes of Neuchâtel and Bienne, for many of the lake dwellings there continued to be inhabited through the iron period, and were probably not abandoned even at the beginning of our era.

With reference to the foregoing remarks respecting the first appearance of iron, and the continuance of lake dwellings till the Roman times, we may remark that a diligent investigation of the settlements both of eastern and western Switzerland will show us that Marin alone bears the distinctive characters of the iron age, although some implements even of the first iron age are found here and there in several stations. We may also rest assured that the Roman implements had no real connection with the lake dwellings.

If the question be asked, what can have been the original motive for erecting such singular abodes, it may be replied, that the same idea originated them all, namely, the isolation of the

inhabitants, and the security of their life and property.* The situation, indeed, was not badly chosen for this purpose. As the neighbouring forests afforded plenty of game, and the lakes an abundance of fish, the inhabitants were equally well placed for fishing, for hunting, and for agriculture. The origin and the arrangement of these lake erections must, in general, have been everywhere the same.

It is very evident that their earliest founders came into middle Europe as a pastoral people, and possessed the most important domestic animals, such as the dog, the cow, the sheep, the goat, and the horse. All these animals have their origin, not in Europe, but in Asia, and were brought here by the settlers through all their long wanderings from the East. They understood agriculture and cultivated different kinds of grain (wheat and barley), also flax, plants which in like manner they did not meet with in Europe, but brought with them out of Asia, or received them by commerce from the south.

The endeavours of the settlers to live together in permanent abodes and in a sociable manner, is a positive proof that they had long known the advantages of a settled mode of life, such as appears in the lake dwellings,† and that we have to look upon them not as wandering pastoral tribes, still less as a mere hunting and fishing people. A settled union of a great number of men in the same place, and of hundreds of families in the neighbouring bays, would never have taken place if there had not been a regular supply of provisions at all times of the year, as well as the beginning of social order.

With respect to the mode in which many or most of the lake dwellings were destroyed, a sufficient explanation is given in the remains of woodwork found in their ruins and in the various objects altered or melted by fire. It is uncertain whether the huts were burnt down always by the hand of an enemy, or misfortune

* The fact, which has been previously mentioned, of many lake dwellings being actually contiguous to the mainland, does not seem entirely to accord with this view, unless it be assumed that in these cases the entrance was fortified by palisades. In fact, the discoveries lately made at Wangen of piles in the bank actually indicate the existence of such an arrangement.

† There must have been many slow transitions from pasturage to agriculture; there is never at the same moment a hard boundary-line between the two, and as the shepherds are the earlier in point of time, it cannot be a matter of surprise that many of their customs and arrangements remained amongst certain tribes who, for a long time, had tilled the ground. On the other hand, certain wandering tribes may probably in the earliest times have attempted agriculture, perhaps few pastoral tribes ever existed entirely without it, and all agriculturists made use of meadows and pasture-grounds though they probably gradually decreased in importance.

of some other kind caused their destruction. Besides this, we may conclude, with great probability, that this isolated, wretched mode of living, by which, especially in winter, all comfort was excluded, except inside of the huts, and which must have been so unfavourable to health, when civilisation advanced and order was gradually developed, and when the mode of living became more peaceable, gradually fell into disuse, and at last was entirely given up; just as, towards the end of the middle ages, the castles and strongholds were abandoned, because the change in the circumstances of their owners allowed them to find pleasanter and safer abodes on the plains.

It has already been remarked that on comparing the implements of stone and bronze from the lake dwellings with those in the Swiss museums, some of which were found in graves and tumuli, and others met with by chance in the fields, we are not able to discover the smallest difference either in material, form, or ornamentation, and we consequently consider ourselves authorised in ascribing all these specimens which appear to have come from similar manufactories to the industry of one and the same people. The identity of the inhabitants of the mainland and those of the lake dwellings appears still more striking if we compare the settlements founded by both classes of the people, as well as their whole arrangements. It is hardly necessary again to refer to the peculiarities of the settlement on the mainland at Ebersberg;* the remains of walls made of wattle-work and clay, the floor also covered with clay, and the slabs of sandstone used for the hearth, form a complete picture of the huts of the lake dwellings. The implements found there consist also of stone, bone, horn, bronze, and earthenware. We find the stone celt, and the grinding-stone, the granite slingstone, pointed tools of stag's horn and bone, figures of the moon made of stone and ornamented exactly like those found at Nidau, pins and personal ornaments of bronze, and clay spindle-whorls. With respect to the pottery also, amongst the vessels found at Ebersberg, there are a great many which, in material, in shape, and in the various ornamentations of stripes, dots, bosses, and

* The reason why settlements such as that of Ebersberg are so seldom discovered, is, that the cultivation of the land, which, even in Roman times, was carried on to a considerable extent, has obliterated the remains of many of the oldest settlements; in fact, at present they are only to be met with in places which have never been brought into cultivation. And as they are not distinguished by outward marks—by earthworks or walls—they are for the most part recognised too late by the workmen, and not being properly investigated, yield under the most favourable circumstances only a few stone or bronze celts.

painting are the most exact counterparts of those discovered at Wangen, Robenhausen, Meilen, Moosseedorf, Nidau, &c. Not a single trace of iron was found amongst the remains of the settlement at Ebersberg, so that its existence appears, like that of many lake dwellings, to have come to an end before the general use of this metal.

From what has been said, it is evident that at the time when colonies of a peculiar kind had settled down on the shores of the Swiss lakes, the valleys and hills were also scattered over with huts, which were only to be distinguished from those of the lake dwellers by being on dry land instead of standing on piles. The grade of civilisation attained by both the lake dwellers and the mass of the population was exactly the same. It is not impossible that the smaller places protected by walls, which have been discovered in increasing numbers by antiquaries on the hills and mountain ridges, may agree in age with the lake dwellings and stand in relation to them as hill-forts to lake-forts. For the history of the development of the human race teaches us that the lower a people is in the grade of civilisation the less are single families held together by a social bond, and the races by common objects; mutual attacks take place by the inhabitants of different valleys and districts, and war becomes a part of the occupation of man. It would, consequently, be a false conception to affirm that there was any ethnographical difference between the lake settlers and the remaining population of the country, and to assume that they were distinguished from each other either by descent or manner of life.

As no national distinction can be proved between the dwellers on land and the dwellers on the lakes, so in like manner no serious doubt can arise as to the identity of the people who first made use of stone celts, then made implements of bronze of admirable quality, and lastly, forged its weapons and tools out of iron. The difference of material used for the various implements marks the epochs which follow each other in the development of one and the same race, not the degree of civilisation of different peoples. An interruption of the civilisation which was gradually advancing, the entrance of a foreign element, is not observable if we examine the monuments still remaining, amongst which we may especially mention the burial-places, and the various implements of the pre-Roman time. In the very same graves and tumuli, implements of stone and bronze, precisely alike in form, have been found lying together, and the same remark will apply in other graves to implements of bronze and

iron. The products of the potter's art also are seen, with all their characteristic peculiarities, through all the stages of their development, and form links in the outward phenomena of the different periods.

We have now finally to say a few words as to the nationality of the people who erected these lake dwellings.

Believing as we do, from what has previously been stated, that the different settlements in what are called the stone, the bronze, and the iron ages do not indicate a succession of races or the destruction of one people by another, but merely different grades of civilisation amongst one and the same people, and a continued progress in handicraft ability; believing also that the lake dwellers did not form a peculiar caste, but, as is shown at Ebersberg and other places, belonged to the very people who at the same time lived on the mainland; and knowing that, according to the universal opinion of many French and English antiquaries, the bronze objects of a peculiar form and quite as peculiar ornamentation, such as those found in the settlements both on the land and in the lakes, have always been attributed to the Celts; knowing also that history makes no mention of any other people but the Celts, who in the very earliest ages possessed the middle of Europe, and in later times received their civilisation from the Romans, we believe that it would be contrary to all the facts adduced to arrive at any conclusion but this:—that the builders of the lake dwellings were a branch of the Celtic population of Switzerland, but that the earlier settlements belong to the prehistoric period, and had already fallen into decay before the Celts took their place in the history of Europe.

The assertion that the Celts, on their first entrance into Europe, which lies far back, as we have just said, in prehistoric time, were acquainted with bronze, and immediately after they had spread over central Europe, applied themselves to mining operations, is unfounded. Though in later times they showed great ability in working this metal, yet a considerable time must have elapsed before they discovered the ore in their new abodes and manufactured the metal. Copper and tin, the component parts of bronze, were not found at all in some districts of which they had taken possession, and in others only in moderate quantities; * and it is probable that the Celts settled in Germany

* There was not a single copper-mine of importance at work in Gaul in Cæsar's time, Plin. xxxiv. 2; and the same authority says that even the Britons, whose country is so rich in copper and tin, procured their bronze from foreigners, Cæsar B. G. v. 12. From

and Gaul, even in later times, obtained these metals by barter. The facts which have been here brought forward, and those revealed also by the graves and tumuli, prove that the remains of the stone and bronze periods, from the circumstances under which they are found, exhibit the different stages of development of one and the same people, and it therefore appears to us inadmissible to call in the Iberians or the Fins or some unknown people as the representatives of the stone age in Central Europe.

Since the above remarks were written, an opinion has been expressed in many quarters, and more especially by my friend Professor Desor in his excellent work, lately published, entitled 'Les Palafittes, ou Constructions lacustres du Lac de Neuchâtel,' that the lake dwellings of the early age were mere temporary abodes, while those of later date were magazines, arsenals, or places of meeting.

Now it appears to me that these theories do not agree with the facts brought forward in the present volume; and I trust that my friend will pardon me if I dissent from his opinion. Discussion is the road to truth, which is the end of all our investigations.

The theory of a mere temporary abode or place of refuge is, in my opinion, contradicted by the following facts:—

The enormous amount of labour required for the erection of these settlements, whether on piles or fascines.

The accommodation evidently afforded in each hut for the convenience of a family: the hearths; the large earthenware vessels for keeping food; the weights for looms, and the spindle-whorls for spinning flax; the pipkins covered either inside or outside with soot; and, in fact, all kinds of domestic arrangements.

The cattle and their stores, which were kept on the lake dwellings.

The repeated repair and re-erection of the settlements after having been burnt; and the relic-beds, lying one above the other, with their enormous quantity of bones and remains of domestic implements.

the fact that copper implements are not found in central Europe, and a regular copper age cannot be shown in this district of country (which, like Gaul, had no tin and but little copper), it follows, as shown by Worsaae, 'that the bronze of the people who settled here was for a length of time obtained elsewhere, at any rate till the necessary mines had been discovered in Europe.' Worsaae concludes that the bronze was brought from Asia as an article of trade, and was then spread amongst the different nations of Europe. With respect to middle and south Europe, which also had their stone age, but at an earlier date than the north, it seems the most natural to attribute the introduction of bronze to the Phœnician coasting trade, which, even as early as this, had engrossed that of the British tin.

The fruits and seeds which had been used as food, and which, as pointed out most clearly by Professor Heer in his interesting work on the plants of the lake dwellings, indicate in a most singular manner that these settlements were used all the year round.

The non-existence, on any of the shores or banks near the lake dwellings of the stone age, of any similar remains. Not a stone celt nor a fragment of pottery, nor a corn-crusher, nor any appearance of a corresponding shore settlement has yet been found.

It appears to me that these facts, taken together, disprove the theory of a mere temporary abode.*

Probably this is the most suitable place to insert a few quotations, from ancient authors, which show that the plan of building upon piles was known in the early days of written history.

We will begin with Hippocrates, to whose works our attention was directed by Mone in his 'Zeitschrift für die Geschichte des Ober-Rheins,' xvii. 4, p. 405. This physician was born about 460 B.C., and the passage occurs in his treatise 'De Aeribus &c.' xxxvii. It runs thus:—

'Concerning the people on the Phasis (now Rioni), that region is marshy and hot, and full of water, and woody; and at every season frequent and violent rains fall there. The inhabitants live in the marshes, and have houses of timber and of reeds constructed in the midst of the waters; and they seldom go out to the city or the market, but sail up and down in boats made out of a single tree-trunk; for there are numerous canals in that region. The water they drink is hot and stagnant, putrified by the sun, and swollen by the rainfall, and the Phasis itself is the most stagnant and quiet flowing of all rivers.'

The next author to be quoted is Herodotus, who was born about 404 B.C. The passage, v. 16, shall be given as translated by Professor Rawlinson.

'They, on the other hand, who dwelt about Mount Pangæum and in the country of the Doberes, the Agrianians and the Odomantians, and they likewise who inhabited lake Prasias, were not conquered by Megabazus. He sought indeed to subdue the

* The above remarks appear in the original in a more extended form as the Preface to the Sixth Report just published. Dr. Keller told me that this preface might probably be omitted with advantage; but as I have more than once heard the theory of temporary occupation mentioned in England, I obtained his consent to the insertion of a very short epitome of his arguments. It seems to me that anybody who has the courage to read through the mass of information contained in the present volume *must* disbelieve the 'temporary' theory.—[TR.]

dwellers upon the lake, but could not effect his purpose. Their manner of living is the following: platforms supported upon tall piles stand in the middle of the lake, which are approached from the land by a single narrow bridge. At the first the piles which bear up the platforms were fixed in their places by the whole body of the citizens; but since that time the custom which has prevailed about fixing them is this: they are brought from a hill called Orbelus, and every man drives in three for each wife that he marries. Now the men have all many wives apiece, and this is the way in which they live. Each has his own hut, wherein he dwells upon one of the platforms; and each has also a trap-door, giving access to the lake beneath; and their wont is to tie their baby children by the foot with a string to save them from rolling into the water. They feed their horses and their other beasts upon fish, which abound in the lake to such a degree that a man has only to open his trap-door and to let down a basket by a rope into the water, and then to wait a very short time, when up he draws it quite full of them.'

We come now to later times: the other quotation we have to give is from Abulfeda, a geographer and a Syrian prince, born in 1273, and died in 1332. The passage, to which my attention was directed by Professor Hitzig, occurs in the 'Supplementa tabulæ Syriæ,' cap. ii., and runs as follows translated into English:—

'The Apamæan lake consists of an innumerable number of smaller lakes and reedy places. Two of them, however, are larger than the others, one to the south and the other to the north. The water of the Orontes pours into them from the south; in fact it makes these lakes, and then runs from them northwards. Of these two lakes then, one, as before said, to the south is the Apamæan lake, about half a parasang (nearly two English miles) across; it is not quite as deep as the height of a man. But the bottom is so muddy that no one can stand upon it. It is everywhere surrounded with reeds and willows, and in the middle of the lake there are quantities of reeds and flags; so that one cannot take in the whole lake at a glance, as these reeds hide part of it from view. Many kinds of birds live in this and the other lakes, such as the * * *, and the auk, and birds which feed on fish, such as * * *, and other aquatic birds in such numbers as are not found to our knowledge in any other lake. In the spring-time the yellow water-lily grows so luxuriantly, and covers the whole surface of the water with its leaves and flowers to such a degree, that vessels going through

that lake have to pass through a regular wood of water-lilies. Between this southern lake and the northern one, there is a wood of reeds, through which there is a narrow channel, by which vessels pass from the southern to the northern lake. This latter lake is reckoned amongst the land of Hesu Borzajjah, and it is commonly called the lake of the Christians, *because it is inhabited by Christian fishermen, who live here on the lake in wooden huts built upon piles.*'

We may further add, in illustration, an extract from a work by M. Adolphe Pictet, 'On some Inscriptions in the Gaulish Language,' Geneva, 1859. It gives the inscriptions themselves, his version of them, and his ideas respecting them.

'Page 35, No. III. Inscription at Autun.

Licnos Contextos ieuru Anvallonnacu canecosedlon.
Licnos contextos vovit Anvallonnaco domum lacustrem.

Page 38, No. IV. Inscription at Volnay.

Iccavos Oppiani cnos jeuru Bringindon (u) Cantabon (an ?)
Iccavos Oppiani filius vovit Bringindono domum lacustrem.

'Page 43. I conclude from these, that *cantabona* is exactly synonymous with *canecosedlon*, and that the two inscriptions are to be translated in the same manner.

'What can be conjectured as to these votive lacustrine edifices which we do not find mentioned elsewhere? We know in a general way that the worship of waters, springs, and lakes was common to the Gauls, the Germans, and other nations; but the exact details are wanting in ancient authors. It is only in the middle ages that we find here and there some indications as to the worship of the waters amongst the population of Gaul. Grimm has collected them in his excellent work on the German mythology.

'We know that in these different places the lakes were thought to be inhabited by superior and formidable beings whose favour ought to be carefully conciliated; hence the establishment of sacred edifices on the banks of lakes and ponds may be naturally explained.

'We may also believe that the erection of lake dwellings, of which so many remarkable remains have been found in most of the lakes of Switzerland, and which appear to reach back to the time of the first arrival of the Celts, may have contributed both to originate and to propagate this worship of the waters, of which, in fact, we know so little. The indications furnished

by our two inscriptions may probably have some importance in this respect, and possibly lead to new discoveries.'

To these notices of pile dwellings from ancient authors and inscriptions, a number of instances of erections somewhat similar might be added from modern history and travels; but as most of them have already been collected and published by other authors, we will only mention one case, which was inserted in the first report on lake dwellings in the Transactions of the Zürich Archæological Association.

It will be found in the account given by Dumont D'Urville of the bay of the city of Dorei, in New Guinea ('Histoire,' vol. iv. page 607). 'The inhabitants,' he says, 'are distributed in four villages at the edge of the water. Each village contains from eight to fifteen houses built on piles; but each house is composed of a row of distinct cells or cabins, and contains several families. Some of these houses contain a double row of cabins, separated by a passage which runs from end to end. These buildings are entirely made of wood very roughly worked; they show the light through in all directions, and often shake when any one walks over the floor.'*

The fishermen's huts which still existed in the river Limmat at the end of the last century were of a similar nature.

* I cannot resist adding one more instance, in a note, as the name of the place arose from the nature of the erections found there. The quotation to be given is from Justamond's translation of the Abbé Raynal's 'Settlements and Trade of the Europeans in the East and West Indies,' vol. iv. p. 68. 'Alphonso Ojeda was the first who reconnoitred, in 1499, the country called Venezuela, or Little Venice, a name that was given to it because some huts were seen there fixed upon stakes to raise them above the stagnant waters that covered the plain.'—[TR.]

FIGURES OF THE CRESCENT MOON.

We have now to draw the attention of antiquaries to a class of objects respecting which there may possibly be a difference of opinion, but which, in any case, are of the greatest interest. Amongst the antiquities found in the mainland settlement of Ebersberg, when examined some years ago (see Plate XCI. figs. 5 and 17), and of which an account is given towards the close of this volume, there were some objects precisely similar to those now about to be described, and which were then considered to be symbolical representations of the crescent moon, and to be connected with the religious worship or at least opinions of the lake dwellers. To this determination of these objects we still adhere, after a careful consideration of all the arguments respecting them, believing as we do that, though they may resemble, as is thought by some antiquaries, the horns of oxen, yet on the whole the probability is greater that they were intended to represent the crescent moon.

Since then a considerable number of similar specimens, both in red sandstone and earthenware, have been discovered, chiefly in the lake of Bienne; as yet they have not been met with in settlements of the earliest age. About two dozen of those made of clay with quartz grains were found by Colonel Schwab at Nidau Steinberg; these specimens are flattened on both sides, and not very thick, but as they were intended to stand, they are provided with a broad base. On the whole they do not differ much in size, the space between the points of the horns measuring from eight to twelve inches, and from the base to the point about six or eight inches. As may be seen from the drawings (Plate XXXVII. figs. 9, 15 and 16, and Plate XLII. fig. 16), in some specimens the representation of the crescent moon has been tolerably well given; in others the workman has been satisfied with the mere indication of its form. All these figures have on one side the same zigzag and line ornaments as are found on the pottery of the tumuli and on the bronze implements. They are very like those found at Ebersberg; the only difference being that the stone specimens have

the horns more slender, and yet, on the whole, the body of the figure is thicker. This would not have succeeded with the images made of clay, for if made thick the mass would certainly have gone to pieces in burning.

Several of these moon images were found at Cortaillod, and are drawn Plate XLV. figs. 2, 4, 6, 8 and 9. They are made of greyish clay, more or less mixed with small stones. The section is narrow, but somewhat broader near the oval base. In Figs. 2 and 4 the horns run to a point; in Figs. 6 and 8 these points are cut off straight across, thus terminating in a flat surface, and in the latter this small flat surface is hollowed. One half of Fig. 2 is ornamented with lines representing the platting of a mat, and the other half is edged with a triple hollowed line. Fig. 4 is ornamented on both sides with straight lines made of a series of impressed dots. Fig. 6 has at each end a deeply impressed hole, round which there is a line drawn by the finger, which is continued in a serpentine form along the borders. Fig. 8 is the point of a moon image, which is perforated, and besides this is ornamented above the hole with engraved circles. On the flat surface there is a fillet running from one point to the other, which, as well as the upper border of the image, is ornamented with diagonal lines. This very singular specimen is in the collection of M. Desor.

Moon images of this kind have been found in other localities, but it is needless to multiply examples.

If we enquire what these things were intended for, it will follow, if we carefully examine them, that they cannot possibly have had any practical use, but were probably placed either inside or outside of the house as ornaments, or more likely as objects of worship. But now comes the question, whether, in ancient writings or on monuments, any proofs can be discovered that the worship of the moon formed a part of the religion of the Celts, to whom we ascribe the erection of the lake dwellings. We certainly do not find one single positive evidence of moon worship amongst this people, but it is especially mentioned as prevalent amongst the Germans. Cæsar, in the sixth book of his Commentaries, in which he treats of the religion of the Celts, does not mention the worship of the moon. With respect to the monuments representing the Druids with the crescent moon, their falsity has been proved long since. The inscriptions also of the Gallo-Roman period, which have been so often quoted, give no certain information on the matter. And yet there are sufficient proofs that the moon had a share in the mysteries of

the Druids, and was honoured and reverenced as holy. For the half moon appears very certainly amongst other symbols on Gaulish coins, more particularly on those which we may especially consider as Helvetian (see vol. iii. part iv. of our Transactions). But the passage in Pliny, xvi. 95 (xvi. 44 of the Edit. Dalecampii, 1587) is the most significant, in which he describes the ceremonies which took place when the Druids cut the mistletoe from the oak. According to the corrected text of Sillig, the passage runs as follows: 'Est autem id (viscum) rarum admodum inventu et repertum magna religione petitur et ante omnia sexta luna, quæ principia mensium annorumque his facit, et sæculi post tricesimum annum, quia jam virium abunde habeat nec sit sui dimidia, omnia sanantem appellantes suo vocabulo.'* This account that the moon, according to the religious ideas of the Gauls, possessed mysterious medicinal power, and was honoured under the name of 'all healing,' completely clears up, as it appears to us, the meaning of the figures of the crescent moon found in the lake dwellings and the corresponding settlements on the mainland. They were sacred emblems of the 'gens admodum religionibus addita,' by means of which, as with the branches of the mistletoe, they imagined that they were able to avert and to cure diseases. This panaceum was probably erected in some open space, perhaps over the doors of the dwellings; so that the ornamented side was exposed to view. From the fact that three moon-images were found in so small a space as the excavation at Ebersberg, and a considerable number in some of the lake dwellings, it is reasonable to conclude that they were numerous in the Gaulish villages, and probably no house was without so important a palladium.

Connected with these moon-images of stone and earthenware may be mentioned the bronze implements, most of which are in the collection of Colonel Schwab of Bienne, and which decidedly bear the figure of the half or quarter moon. Plate XLII. fig. 8, is of this form, with a broad latticed handle

* 'The mistletoe is not commonly met with, but when found, it is gathered with great solemnity and especially on the sixth day of the moon, which they reckon as the beginning of their months and years, and of a period of thirty years, because it then has sufficient power and has not yet become half. They call it (the moon on the sixth day) 'all healing.' The clause 'omnia sanantem,' which can only be taken in reference to 'sexta luna,' is in many editions erroneously separated from the context.

The passage in Pliny, xxix. 12 (xxix. 3, of the Edit. Dalec.), also refers to a secret power of the moon. The words 'certa luna' here used when the Druids were taking the serpents' eggs, probably mean also the first quarter of the moon.

fastened to the convex side. Like the bronze sickles, one side is flat, and the other has raised ridges upon it. Though a bronze casting, it is very thin, and is not capable of bearing any pressure whatever. The one drawn Plate XLVI. fig. 8, is very similar, but it is rather larger, and the outside terminates in a sharp cutting edge. Plate XLIV. figs. 6, 7, and 8, on the contrary, have no cutting edge. Fig. 7 is ornamented on both sides with raised lines.

Plate LXII. fig. 18, shows the handle, and Fig. 14 the middle portion, of similar instruments found in the Marniera of Campeggine; the latter differs in some slight particulars. Amongst the specimens found in the settlement of Uetliberg on the mainland, is the handle of an implement evidently of the same nature; it is ornamented with studs placed irregularly (Plate XCII. fig. 9). All these implements were intended for suspension.

Very similar moon-shaped cutting instruments of bronze have been found in an Etruscan grave near Bologna; but in these cases the handle is not placed symmetrically like those from Switzerland, but is fixed on towards the point of one of the horns. (See the treatise 'Di un sepolcreto etrusco scoperto presso Bologna, descrizione del conte Giovanni Gozzadini,' Bologna, 1855.) In the appendix to this interesting work, which is accompanied by excellent drawings, Professor F. Rocchi, in a learned dissertation 'intorno l' antichità dell' uso di radersi la barba,' points out the possibility of these implements having been used as razors. This explanation for a length of time did not seem satisfactory to me, as several of them were not sharpened, but perfectly blunt at the edges, so that they appeared to me to be merely ornaments in the form of a crescent. But since then, having seen and examined a number of specimens of various forms, I have come to the conclusion that they may in all probability be considered as cutting instruments of some kind or other. Implements of this nature would be required for cutting leather and cloth; and it must be borne in mind that as yet no scissors or shears have been found of this age. The fact of some specimens having a blunt edge may be explained by the necessity for its being well hammered, in order to make it cut. Bronze becomes denser, harder, and more fit for cutting tools by the process of hammering.*

* With respect to the hardening of bronze, there are several modes of accomplishing the point. See Caylus Rec. i. p. 242. It is now said to be practised to a considerable

MANUFACTURES OF VEGETABLE FIBRE, FLAX, ETC.

Amongst all the antiquities found in the lake dwellings, probably none are of more interest, or have a greater bearing on our ideas as to the civilisation of the inhabitants, than the various manufactures of 'bast' or vegetable fibre, and of flax. The variety of patterns is great, and apparently they have all been produced by very simple means.

Hitherto specimens of this nature have been chiefly found in the lake dwellings of the earlier periods, though some have been met with in the settlements of later age, in the lake of Bienne.

Some surprise having been expressed as to the perfect preservation of these frail specimens of early industry, it may be well to state that we owe it entirely to the fact, that at the time the huts were destroyed, they fell burning into the water before they were entirely reduced to ashes, and were very soon after covered over by the mud of the lake.*

The need of fastening, binding, and sewing is one of the most primitive wants, and led men in early times to the use of simple threads and cords ready prepared for them by the hand of nature; these consisted either of objects taken from the vegetable kingdom, such as the stalks of the stronger kinds of grass; stems of reeds, twigs and fibres of trees, or materials from the animal kingdom, such as sinews and intestines, and skins cut into strips, the use of which, however, required a

extent by several processes, one of which is simply the addition of a very small percentage of iron; a patent was taken out in England for this process some years ago.—[TR.]

* To a geologist there can hardly be any difficulty in the matter; any one who has looked over a collection of fossils from the fresh water formation of Œningen will remember the delicate vegetable fibres, exquisitely preserved in this rich locality; and these are not carbonised, but simply chemically changed. But there is no necessity to confine ourselves to a tertiary formation; let the same individual examine the vegetable remains from the old red sandstone (one of the palæozoic group) near Thurso, and he will cease to be sceptical as to the specimens of cloth from the lake dwellings. Indefinite preservation only requires a combination of circumstances, and these we fortunately possess in some of the lake dwellings.—[TR.]

certain degree of preparation. By means of binding materials of this description, tools and weapons could be fastened to their handles, stems and branches of trees could be bound together, and huts erected. Binding or tying naturally led to platting and to forming a flat or extended surface, and hence arose mats and baskets, which the human hand is quite capable of preparing with the help of the simplest tools. Experience would soon indicate the best material afforded by nature, amongst which was flax, which possessed the requisite qualities in the highest degree. The use of flax, according to history, reaches back to the earliest period of civilisation, and was carried on in the lake settlements to a considerable extent. Flax was the material for making lines and nets for fishing, and catching wild animals; cords for carrying the earthenware vessels and other heavy objects; in fact, one can hardly imagine how navigation could be carried on, or the lake dwellings themselves be erected without the use of ropes and cords; and the erection of memorial stones (Maenhirs, Dolmen), at whatever era and to whatever people these monuments may belong, would be altogether impracticable without the use of strong ropes.

After the different processes of working flax were in operation, such as spinning, entwining, platting, knitting, and weaving, and after the settlers had learned without trouble, and by a simple mode of manufacture, to prepare linen cloth, so admirably adapted for coverings and clothes, then appeared the innate propensities of human nature to give variety and elegance to the products of manual labour; and as we often see this tendency pleasingly shown in the mats of savages, so we find also in the products of the lake settlers' looms numerous attempts at variety and ornament.

In describing and examining the many specimens of platted and woven cloth discovered by Mr. Messikomer at Robenhausen and Mr. Löhle at Wangen, it will be necessary in the first place to take a view of the commencement of this kind of industrial exertion as shown in several specimens found.

Amongst the simplest means for binding and fastening, may be classed the ropes and cords formed by twisting together thin twigs, especially those of the willow; rough ropes of this kind have been found of various sizes and resemble the handle of a basket.

Ropes and lines have also been discovered of less tough materials, such as rushes, reeds, straw, &c.

The bast or vegetable fibre (of the lime tree) was very commonly used, partly alone, and partly mixed with reeds and strips of flax.

The bast in its most simple form, appears as a single strip or band, binding together pieces of wood or other materials; then we find these strips of bast twisted together so that the section is of a circular form, and still more commonly in the shape of rope composed of several twisted bands entwined; a form of manufacture in which may be recognised the commencement of the ropemaker's art. (Plate LXXXII. fig. 1.)

The mats platted out of strips of bast may be considered as the products of an advanced degree of industry connected also with the art of the basket-maker. The first and most simple kind of these mats, consists of a trellis work of strips or bands platted crosswise one with another. (Plate LXXXII. fig. 2.)

A second and more complicated kind consists also of a kind of trellis work, of which the warp is made of twisted strips of bast and the woof of flat bands; the latter probably more for appearance than for increasing the strength are divided on the ridge of the cross piece into two, through which the next band is drawn and then again united on the opposite side of the plat —an arrangement commonly found in the baskets and mats of the present day. (Plate LXXXII. figs. 3 and 4.)

Plate LXXXII. fig. 5 shows a series of small willow rods, arranged in a radiating form, platted together by strips of bast running concentrically in such a way that both together form a structure like what is called 'herring-bone.'

In Plate LXXXIII. fig. 1 double strips of bast are bound together very neatly by being platted with other strips of bast and cords.

In a third kind, the entwined strips of bast are wound round in the form of a spiral, and then bound together by flat bands. There are several varieties of this kind of platting, but we cannot venture on giving a detailed account of them.

One variety had evidently required much skill in the manufacture; it is not uncommon, but has never been found perfect; the use of it has not yet been determined. We cannot give the whole length of the object, but the point is drawn Plate LXXXIII. fig. 2. It consists of a reed forming the central piece, and four splinters of the same material, which are platted together and enclose the reed like a 'core' or central portion in a cylinder. The specimens found vary both in thichness and also in the fineness of the work; the structure

somewhat resembles that of our modern horsewhips which are bound round by cords.

Plate LXXXII. fig. 6 is a piece of a mat platted out of bast, and differing from any other yet found. The front is regular and smooth, while the back (Fig. 7) is carelessly made. The broad bands by which the narrow double strips of bast lying in straight lines are platted together appear to pierce through to the lower side, probably to give more firmness to the plat. Fig. 8 shows the single bands separated and gives an idea of the mode of manufacture.

Many other kinds of manufacture made of bast, or of bast mixed with twigs, have been discovered, but only in small fragments, and in such bad condition from having been burnt, that it is impossible clearly to make out their structure. It is, however, to the fact of their having been burnt that we owe their preservation; had it been otherwise we should probably never have known anything of these singular specimens of the industry of the lake settlers.

No hemp has yet been found in any lake dwelling. The use of flax reaches back to the very earliest periods of civilisation, and it was most extensively and variously applied in the lake dwellings, even in those of the stone period. But of the mode in which it was planted, steeped, heckled, cleansed, and generally prepared for use we can form no idea, any more than we can of the mode or the tools employed by the settlers in its cultivation. Still less can we decide whether, as was the case with all the ancient eastern nations, the preparation of the flax and the spinning and weaving fell to the lot of the female part of the community. The specimens of unworked flax, or that in stalks with the seed-vessels attached (of course burnt), belong, according to the opinion of the best judges, to the variety which is very generally cultivated in the north-west of Switzerland under the name of short flax. Even in the best soil this smaller kind never grows as high as the larger sort; it is simply preferred because it yields finer fibres, bears the climate better, and is not so easily laid by the wind.

Rough or unworked flax is found in the lake dwellings made into bundles, or what are technically called 'heads,' and as much attention seems to have been given to this last operation, it was perfectly clean and ready for use. The mode of working this description of flax (that is without being spun or twisted) is shown in various kinds of platted work. The most simple kind of this manufacture is drawn Plate LXXXIII. fig. 3. We

see here strands of this material laid in straight lines close to each other, and bound round and fastened together by similar strands. Flax brought into this form might be used as a mat, or a covering to wrap round the person.

A remarkable and very complicated union of strands of flax and bast is represented Plate LXXXIII. fig. 4. It consists of two different layers, the lower of which is thick and soft, and is made up of a number of strips of flax, ranged parallel to each other, one row overlapping the next like tiles (Fig. 4 *a*). Nothing could be ascertained as to the arrangement of these rows inside as the specimen was so much burnt; apparently, however, each row was formed of a single strip worked sinuously backward and forward.

The upper layer of this plat consists of long narrow strips of bast, placed double and ranged parallel with those of the underlayer; in fact, so that every two strips of the bast correspond or are equal in breadth to one of the strips of flax in the lower layer. At a distance of nearly an inch apart, which answers to the space occupied by the rows of the under layer, these strips of bast of the upper layer are bound together by a sinuous cross-band platted round them (Fig. 4 *c*, *a*), which is also made of two narrow strips of bast. One of these cross-bands is placed just over the edge of every row of the strips of flax in the under layer where they overlap. The mode of joining the upper layer of bast with the soft under layer of flax is remarkable. This is done by a narrow strip of bast, *b*, underneath *a*, placed above the opening or loop of every strip at right angles over the cross-band of the upper layer (see the lower *a* and *c*), and then both ends of it are drawn through the strip lying underneath so as to enter from behind the strip of flax which is next to it, and thus fasten the cross-band to the under layer. Thus this narrow strip performs the double office of fastening the upper layer of bast to the soft under layer, and of binding the strips of flax themselves one to another. Fig. *a* shows the upper ends of the upright strips of bast placed double, one after the other; a thin cord or strip is drawn through these ends or loops to prevent them from slipping through the cross-band.

In another fragment (Plate LXXXIII. fig. 5) the strap *b*, which joins the two layers together, is not to be seen. These two specimens are somewhat similar in character to that drawn Plate LXXXIV. fig. 4, described below, which is entirely composed of flax.

Even before the discovery of the remains of actual threads it might have been concluded from the abundance of burnt flax fibres, and of clay spindle-whorls (Plate III. fig. 13), that the art of twisting raw flax into a thread was known to all the lake settlers, and formed one of their leading occupations. The bundles found at Robenhausen both of simple yarn, and also of thread made of two or more strands twisted together, proved the great ability possessed by the settlers in the art of spinning. It is uncertain whether the yarn, the simple single twist, had any definite use, but the threads made of several lengths of yarn twisted together are met with in great plenty, and of various thickness, wound into skeins and neatly bound up (Plate LXXXIII. figs. 6, 7, 8). String and rope half an inch in diameter, made of several strands twisted together, occur of excellent workmanship, as if they had been done by a rope-maker (Plate LXXXIII. figs. 9 to 15). The beautiful balls or hanks of string (Figs. 2 and 6 on Plate XIV.) have been already referred to in the account of Robenhausen. As navigation, fishing, and hunting were apparently carried on to a great extent by the inhabitants of the lake dwellings, it may be readily imagined that the production of cords and ropes must have been a very important matter.

Of plats and netting made from flax spun into threads the first thing which may be noticed is the kind of knot used. Plate LXXXIV. fig. 10 represents a regular weaver's knot, and the annexed wood-cut is the same a little loosened. Plate LXXXIV. fig. 9 is an entwined mass of skeins of flax loosely twisted together; this specimen cannot be accurately examined on account of its having as usual been burnt.

Fig. 15.

Of netted manufacture the most simple forms are the nets, which vary considerably both in the strength of the cord, and in the size of the meshes, according to the purposes for which they were designed, and yet they seem all to have been made in the same manner. Plate LXXXIV. fig. 2 gives a drawing of the medium sort of this manufacture used for hunting and fishing. Plate LXXXV. fig. 2 shows the piece of a net with large meshes.

Plate LXXXIV. figs. 1, 3, 4 and 5 give the patterns of four kinds of platted cloth remarkable both for their ingenious structure and for the accuracy and care of their workmanship.

The first (Fig. 1) is made by a number of small cords lying close

to each other; it may have been used for a mat, a covering, or as material for clothing.

The second specimen (Fig. 3) consists of strong strings which are bound together at certain intervals by double cross-strings. It forms a very strong cloth pervious to light and air.

The third (Fig. 4) is like the one first described, bound together with a single cross-cord; at the border, *a b*, the warp is turned round a thin string.

It is remarkable for having on one side strips of raw flax platted in the material in regular rows, and which afterwards had been cut open, and thus formed an artificial pile. This specimen throws some light on the fragments drawn Plate LXXXIII. figs. 4 and 5, which were made in a similar way of strips of bast and of raw flax, and which have also the appearance of a pile. There can be no doubt that this material was used for clothing.

The fourth specimen (Fig. 5) according to the views of those versed in such matters, is also to be considered as a kind of platted cloth, though from the regularity of its make it might have been thought to be woven. The string forming the woof is entirely lost to view under the cross-strings ranged close together by which it is entwined. This firm and fine material evidently was quite adapted for garments.

Three pieces of woven cloth are drawn Plate LXXXIV. figs. 6, 7, 8, made not by the hand alone, but by some mechanical means which, however simple may have been its construction, must be considered as a weaving apparatus. The invention of the loom, that is of a simple frame for stretching the longitudinal threads, with an arrangement for weaving in the cross threads, reaches back to primeval times.

The specimen (Fig. 8) where the threads of the woof cross the threads of the warp at right angles, is simple coarse cloth. The thickness of the threads, and the distance between them varies considerably, and yet the number of threads both in the warp and in the woof in a square inch of surface, is on the average between 25 and 34. Closely woven cloth has not yet been found, nor what was made with strong threads, nor, in fact, have any specimens come to light which in uniformity and regularity of work can even in a remote degree be compared with the products of the present day.

The next specimen (Fig. 6) differs from the last in having every alternate three threads partly left out, by which the cloth becomes ribbed.

The third sort (Fig. 7) is a woven cloth having the appearance of a fringe, which may have been used for trimming the garments; skeins of thread are woven together at one side by means of a narrow thread border, and the other side of them is cut so that the threads hang down loose.

Plate LXXXIV. fig. 11 is the drawing of a kind of ribbon. The warp consists of two threads of unequal thickness which interchange and form neat cross stripes.

One of the most singular specimens of manufacture from flax, is drawn Plate LXXXV. fig. 1. It is a piece of very strong platted cloth similar to that drawn Plate LXXXIV. fig. 1, but it is remarkable for having a four-cornered pocket of common simple linen cloth, like that drawn Plate LXXXIV. fig. 8, sewed on to it with thread and string.

But the most remarkable of all is the embroidered cloth discovered within the last few weeks at Irgenhausen and described in the account of that place. (See Plate XCIV. fig. 2.)

Plate LXXXVI. fig. 1 represents the middle portion of some piece of clothing made of strands of flax neatly platted; probably it was a covering for the head like the leather caps so much in use in many of the Swiss valleys. This cap is arched towards the middle. The outermost border and the third row of strips have been destroyed. Fig. 2 represents one side of the cup, or what is called the strap, of a sling; it was made by platting flax cords together. A portion of the string to which it was attached is shown on the right of the figure.*

At the close of this account of the cords, ropes, and platted work of twigs and bast, and the platted and woven flax cloth found in the lake dwellings, we have one remark to make, viz. that after a careful examination of the products of the last mentioned kind, we have never found—with the exception of the pocket and embroidery just mentioned, and one other hem made by a needle—any kind of seam or appearance of the cloth having been cut out; so that, at any rate for the present, we adhere to the conjecture that this woven cloth was used as a kind of general wrapper rather than made into clothes fitted for the different parts of the body.

On the other hand, we find many fragments of the simple

* 'Qui fundis ex lino vel setis factis (has enim dicunt esse meliores) contorto circa caput brachio dirigunt saxa.'—Vegetius *De re militari*, lib. iii. cap. 14.—[Tr.]

cloth, drawn Plate LXXXIV. fig. 8, in which the empty spaces between the threads are filled in with some kind of material, so as to change the cloth, which originally is in its texture almost like a fine sieve, into something having the appearance of burnt paper, and to make it quite impervious to light. The nature of this substance can hardly be ascertained; it may possibly have been used to make the cloth waterproof. These specimens also naturally suggest the question whether the substance thus adhering to them may have been a colouring material, and whether they may not be considered examples of dyed or painted cloth, the making of which reaches up to the highest antiquity.*

Looms.—When we received from Mr. Messikomer the first specimen of burnt linen cloth, which was, in fact, one of the most complicated patterns, we could not repress the conjecture that in that locality there had been a mixture of products of very different ages, and that the woven cloth might have fallen into the canal by accident from some place or other on the bank. Ignorance of metals and handicraft, arrangements of the most primitive kinds found together with products of an advanced industrial knowledge, as shown by machine-made linen cloth, appeared to us an impossibility in the history of civilisation. But a careful examination of the locality by geologists and antiquaries soon proved that there was no illusion in the matter, and that these questionable specimens are the actual relics of the lake dwelling settlers, and belong to the same age as the implements of stone and bone.

This discussion as to the age of the woven cloth necessarily led to the enquiry, what might be the form and construction of the machine which enabled the inhabitants of the lake dwellings to bring to perfection such admirable manufactures. It is known from the writings of the ancients that weaving was very early brought to great perfection, and it is also known that at the present day very good cloth of various kinds is made in Arabia, Persia, and India, by machines of the simplest kind. Of one of the earliest civilised nations of antiquity, the Egyptians, we possess, in fact, not merely in their woven cloths the actual

* It is remarkable that Herodotus, only a page or two before describing the pile dwellings on Lake Prasias, referred to elsewhere in this volume, relates a story as to two Pæonian brothers and their sister drawing the attention of Darius to the occupation of spinning flax, 'which was neither like that of the Lydians, nor of the Persians, nor of any of the dwellers in Asia.' This account will be found book v. 12, 13.—[Tr.]

proofs of their proficiency in this department of industry, but we find on the monuments which they have left behind them representations of the whole process of preparing and working flax, heckling, spinning, twisting, &c.; and also drawings of two kinds of loom, one lying on the ground and one standing upright.* It was, indeed, possible that the specimens of woven cloth under consideration, even if found amongst the remains of flax stores and spinning-rooms, might have been brought here by commerce with some civilised nation; but all doubt vanished as to their having been made on the spot where they were found when Mr. Paur, a ribbon manufacturer of Zürich, noted for his knowledge of weaving machinery, and taking an interest in these early productions of his art, constructed an exceedingly simple weaving machine, by which with the greatest ease he made cloth of all the various kinds drawn Plate LXXXIV. And, as a further proof, he showed from indubitable evidence that the clay cones, described page 146, and drawn Plate XXXVIII. fig. 16 and elsewhere, are to be considered as constituent parts of the looms of the lake dwellings. If further proof were wanting, it may be given in the fact that in several rooms lately excavated by Mr. Messikomer at Robenhausen, at least half-a-dozen of these clay cones were found in each, so that weaving must have been carried on there to a great extent.

Mr. Paur has favoured us with the following account of the mode which the settlers probably adopted to manufacture their woven cloth, and also of the simple machine required for this purpose.

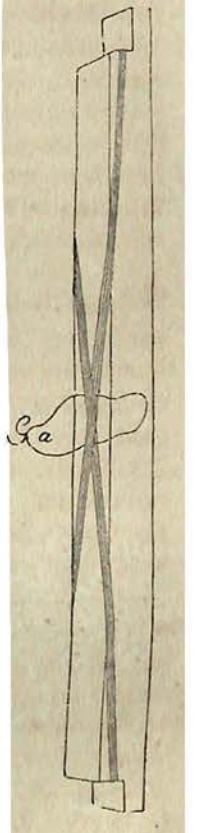
It must, however, be fully understood that, with the exception of the clay balls, cones, or weights, the following account is *ideal*; but there is every probability of its being perfectly correct. There can be no doubt as to the great variety of patterns of cloth discovered; this account merely states what a very simple machine would be required to produce these various specimens.

'The first thing to be done is to arrange the yarn for the warp into simple sets of about forty threads each. What is called the "Rispe," or the crossing of the threads, is done by winding the threads crosswise on a wooden frame, as shown in the annexed wood-cut (Fig. 16). The "Rispe" cord, *a*, drawn through cross-

* Sir Gardner Wilkinson, ii. 60; iii. 135. The ancient northern loom is described in Worsaae's 'nordiske Oldsager,' p. 159.

wise, keeps the threads firm in this form. The sets of thread are next to be hung in a row as broad as the cloth to be made, on the warp staff *a a*, of the wood-cut (Fig. 17), which rests on two upright forked stems or branches, and they are to be weighted at the lower ends by clay balls or cones. Instead of the "Rispe cord" of each separate set of threads two longer cords *b b*, are now drawn through the whole breadth of the warp (see Fig. 17). The next step is to fasten by means of a slipknot the first of every four threads to a round cross staff 1 (Fig. 18.) The second thread is then fastened to a second staff; the third to a third, and so on; so that the whole of the threads are distributed on the four staves (see Fig. 19). Lastly, the weights are to be hung on in such a way that only the threads from one staff are fastened to one and the same ball; when this is done, both the "Rispe" cords, *b b*, are taken away and the labour of weaving may begin.

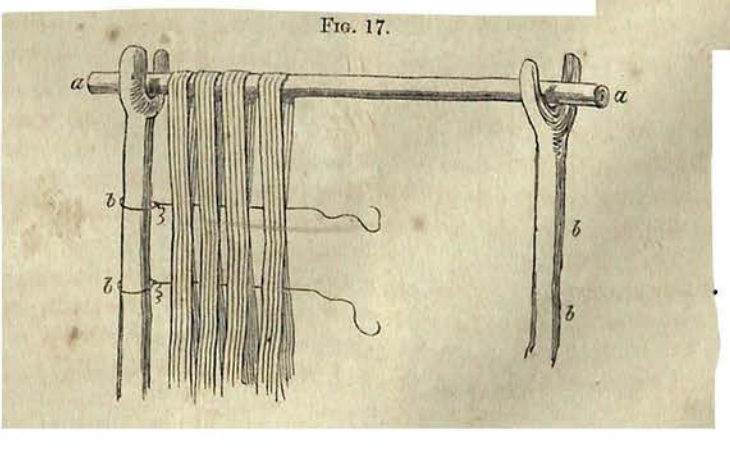
Fig. 16.



'The distribution of the warp on the different staves just described, enables the workman to draw out either one, two, or three threads and to let the others remain, and thus by this change of the threads drawn out to produce various kinds of patterns.

'The manufacture of the peculiar ribbed cloth drawn Plate LXXXIV. fig. 6 yet remains to be described. Nine threads of the warp are fastened on four cross-staves in the following order:—

Fig. 17.



Threads on Staff	1.	2.	3.	4.	5.	6.	7.	8.	9.
	1.	2.	1.	3.	4.	3.	1.	2.	1.

At the first 'cast' of the shuttle, staff 1 is drawn.

„ second . . . . . 2 & 4 „
„ third . . . . . 1 „
„ fourth . . . . . 2 & 3 „

Fig. 18.

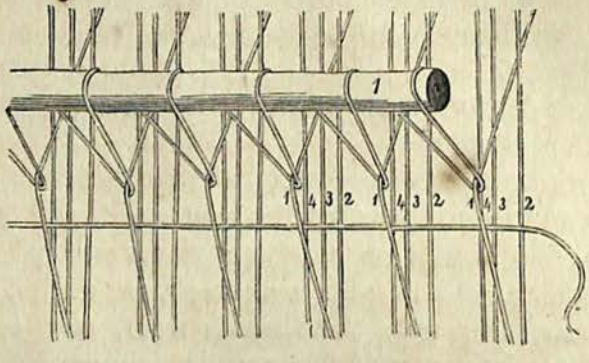
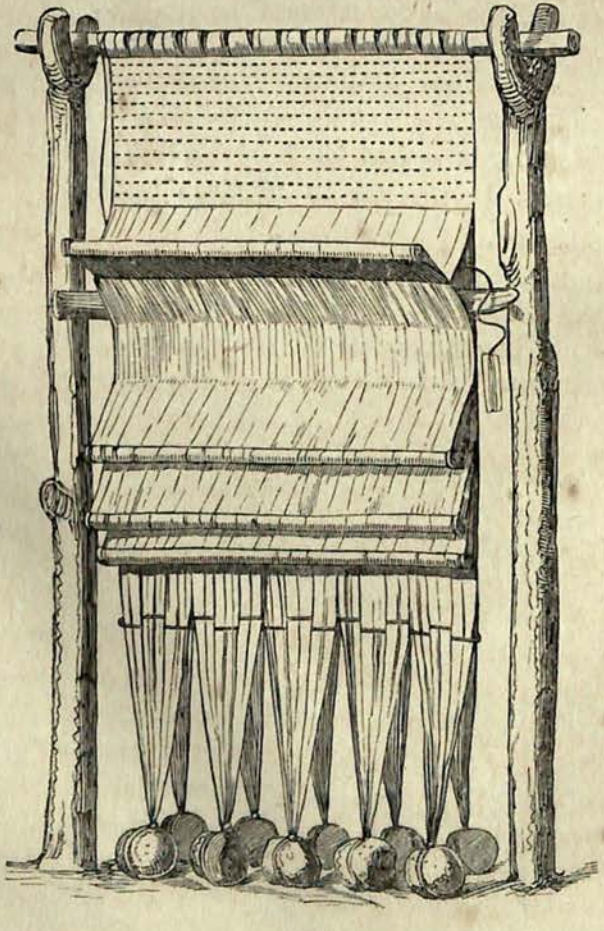


Fig. 19.



'The above arrangements are all that are required for manufacturing linen cloth exactly similar to all the varieties drawn Plate LXXXIV.'

LEATHER.

It was natural when men pressed forward into the inhospitable regions of middle and northern Europe, that they should feel the need of some clothing for the person to enable them to bear the rigour of the climate. A material well adapted for this purpose would be found in the hides and skins of beasts, either of those which followed the wandering tribes as domestic animals, or of those killed in the chase. The earliest clothing of the inhabitants of Switzerland cannot materially have differed from that which we see in our own day amongst the uncivilised people of the far north. The manufacture of stone and bone implements and of earthenware bowls, the construction of huts and the preparation of skins and hides for covering the feet and other parts of the body, must have been practised amongst the settlers as one of their most indispensable labours, and have been carried on to a great extent. Unfortunately we possess only the most sparing indications as to this department of the settlers' economy, for the leather was entirely altered by the heat and spoiled by the water. And yet amongst the relics of the settlers which lie entombed in the mud of the bed of the lake, a number of pieces of leather have been found, the use of which is indeed unknown, but which still prove to us that some mode of preparing leather so as to make it supple and durable was not unknown, and that consequently the first elements, at least, of the currier's art were in use amongst the inhabitants of the lake dwellings. We will not venture to run into conjecture as to the mode in which the raw skins were treated; it will be sufficient at present to state the fact, of which we are assured by those versed in these matters, that the appearance of the leather found at Robenhausen certainly shows that it had been artificially prepared; and the late discovery of a wooden last in the same locality as described in the notice of this settlement, proves that the colonists protected their feet by some kind of sandals, in all probability made of leather.

ABSTRACT OF THE

TREATISE ON THE 'PLANTS OF THE LAKE DWELLINGS.'

By Dr. OSWALD HEER.

Zürich, 1866.

[Professor Heer, to whom we have been indebted for previous information as to the plants of the lake dwellings, has lately published a most interesting work with the above-mentioned title, and in the kindest manner has allowed us to take extracts from it, and also to make use of his valuable illustrations.]

The remains of the plants referred to in this treatise are found lying in the lake mud, or buried under a bed of peat several feet thick. They have to be collected out of a soft, dark coloured mud, which formed the ancient lake bottom, and is now called the relic-bed. Stones and pottery, domestic implements and charcoal ashes, grains of corn and bones, lie together in a confused mass. And yet they are by no means spread regularly over the bottom, but are frequently found in patches. The places where bones are plentiful, where the seeds of raspberries and blackberries, and the stones of sloes and cherries, are found together in heaps, probably indicate where there were holes in the wooden platform, through which the refuse was thrown into the lake; while those places where burnt fruits, bread, and platted and woven cloth are found indicate store rooms in these very spots on the lake dwellings when they were burnt, and thus the contents fell into the water. The burnt fruits and seeds, therefore, unquestionably belong to the age of the lake dwellings; and a portion of them are in very good preservation, for the process of burning has not essentially changed their form. The same remark applies both to the apples and the corn, as the outer rind for the most part has neither separated nor shrivelled up. Many of the remains of plants, however, have been preserved in an unburnt state. But as, when these seeds are taken up out of the mud of the relic-bed, it is

not impossible that plants and seeds from the neighbouring bank may get mixed with them, great caution is required in discriminating. Fortunately we have the means of distinguishing the ancient seeds and fruits from those of the present day, for, in the ancient seeds, the inside portions—the germ and albuminous part, have disappeared, and only the burnt cellular part, which forms the seed-shell or pericarp, has remained; consequently, all endeavours to make the seeds germinate have proved fruitless. Thus the seeds of raspberries, goosefoot, water-lilies, &c., are hollow inside, and in some cases only a brown powder indicates the remains of the former contents: the same remark applies to the stones of cherries and sloes, to hazel-nuts, cornels, the seeds of pond-weeds, &c.

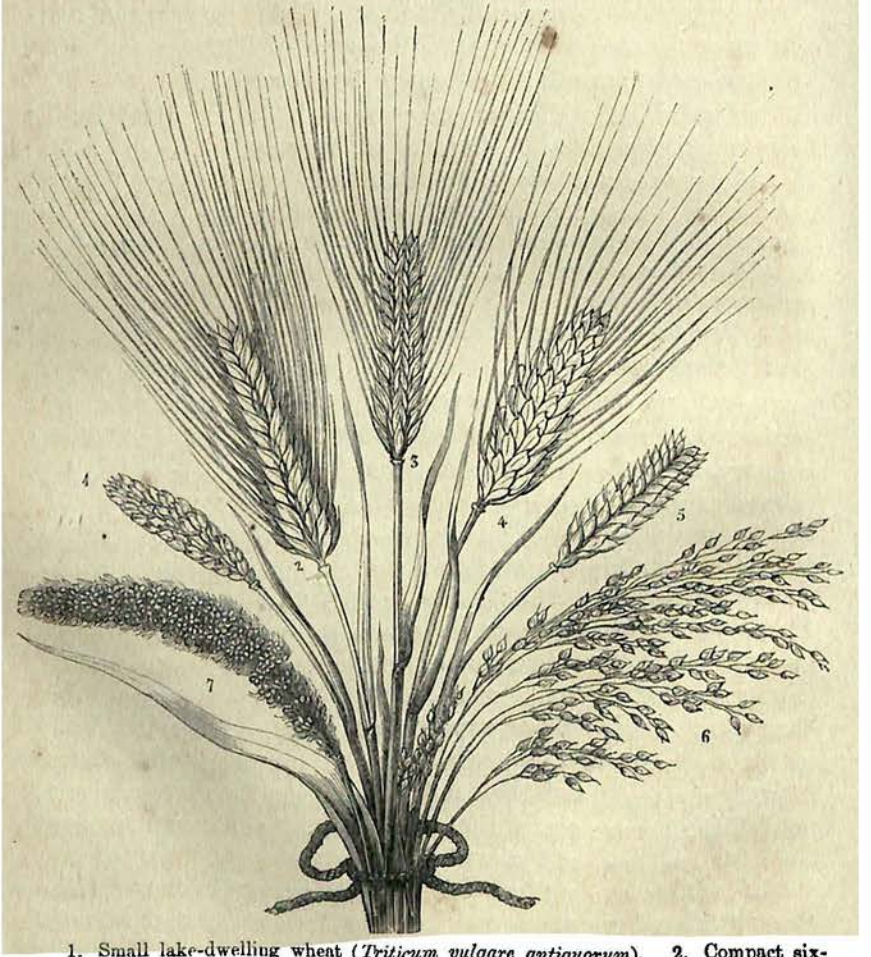
Professor Heer divides the plants hitherto found in the lake dwellings into—1. Cereals; 2. Weeds of the corn-field; 3. Culinary vegetables; 4. Fruit and berries; 5. Nuts; 6. Oil-producing plants; 7. Aromatic plants; 8. Bast and fibrous plants; 9. Plants used for dyeing; 10. Forest trees and shrubs; 11. Mosses and ferns; 12. Fungi for kindling fire; 13. Water and marsh plants.

1. *Cereals.*—The small-grained, six-rowed barley (*Hordeum hexastichum sanctum*), and the small lake-dwelling wheat (*Triticum vulgare antiquorum*), were the most ancient, most important, and most generally cultivated farinaceous seeds of our country. Next to them come the beardless compact wheat (*Binkelweizen — Triticum vulgare, compactum muticum*), and the larger six-rowed barley (*Hordeum hexastichum densum*), with the two kinds of millet, the common millet (*Panicum miliaceum*, L.), and the Italian millet (*Setaria Italica*). The Egyptian wheat (*Triticum turgidum*, L.), the two-rowed wheat (*Emmer—Triticum dicoccum*, Schr.), and the one-grained wheat (*Triticum monococcum*), were probably, like the two-rowed barley, only cultivated as experiments in a few places; and the spelt (*Triticum spelta*, L.), which at present is one of the most important cereals, and the oat (*Avena sativa*, L.), appeared later, not till the bronze age, while rye was entirely unknown amongst the lake dwellings of Switzerland.

The millets are undoubtedly spring crops; in fact all the other kinds of cereals appear to have been the same. Consequently, the colonists must have prepared and sown their fields in spring, not in autumn; and the corn was probably housed at the end of summer, and no after-crops secured. The beds of goats' and sheep's dung discovered in the lake dwelling of

Robenhausen seem to indicate that the fæces were allowed to accumulate in the stalls, in order to be used for manuring the fields. Bread was made only of wheat and millet, the latter with the addition of some grains of wheat, and, for the sake of flavouring it, of linseed also. Barley bread has not yet been found, and it is probable that barley was eaten boiled, or more probably parched or roasted. The small, six-rowed barley of the lake dwellings is the sacred barley of antiquity. The small lake-dwelling wheat (*Triticum vulgare antiquorum*) is

FIG. 20.



1. Small lake-dwelling wheat (*Triticum vulgare antiquorum*). 2. Compact six-rowed barley (*Hordeum hexastichum densum*). 3. Small six-rowed barley (*H. hexastichum sanctum*). 4. Egyptian wheat (*Triticum turgidum*, L.). 5. *Emmer* or two-rowed wheat (*Tr. dicoccum*, Schr.). 6. Common millet (*Panicum miliaceum*, L.). 7. Italian setaria (*Setaria Italica*).

probably the oldest sort; it is the most prevalent cereal in all the older lake dwellings, and it was cultivated down to the Gallo-Roman times.

The preceding woodcut gives a sketch of some of the more important kinds; it can hardly be called a 'restoration,' as in many cases the actual ears have been found.

We know very little as to the agricultural tools, though several implements have been found which are considered to belong to this class. Neither do we know how the corn was gathered, though in all probability it was not cut just under the ears (a mode which is represented on some ancient Italian coins), but the straw must have been taken up with it, otherwise there would not have been the seeds of so many weeds with the corn. It was then, probably, trodden out to separate the corn from the husks (thus the Roman term *triticum* from *triturare*), and after being cleaned, the barley may have been freed from its hard parts by a club. Implements of this kind appear on coins of Metapontum, amongst agricultural tools, and several clubs have been found at Robenhausen. The women of Southern Africa are mentioned by the Livingstones in their travels, lately published, as having to perform this operation with a kind of pestle and mortar. We know how the corn was crushed and ground; it is needless here to refer to the corn-crushers and mealing-stones found in nearly every settlement. Some of the meal was then made into bread, of which charred portions are still met with. In other cases, the grain was probably roasted, then crushed, and put into the pipkin, and the mass, after having been somewhat soaked, was then eaten. The Spaniards, when they conquered the Canary Islands, very singularly found this mode of preparing corn food prevalent amongst the aborigines; they adopted this custom, and have continued it to the present day. The corn there is still roasted in ovens, prepared for this especial purpose, then ground, placed in goatskins, and thus stored. This 'Gofio' as corn-meal is called, when thus prepared, forms now the food of the lower orders of the people in the Canaries, and may certainly be considered as the oldest form of making use of corn.*

Parched barley was the sacred corn of the ancients, and took a very important place in all their sacrifices.

2. *Weeds of the Corn-field.*—Some of these were indigenous,

* *Odyssey*, ii. 354. Telemachus does not take bread for his voyage, but meal in skins.

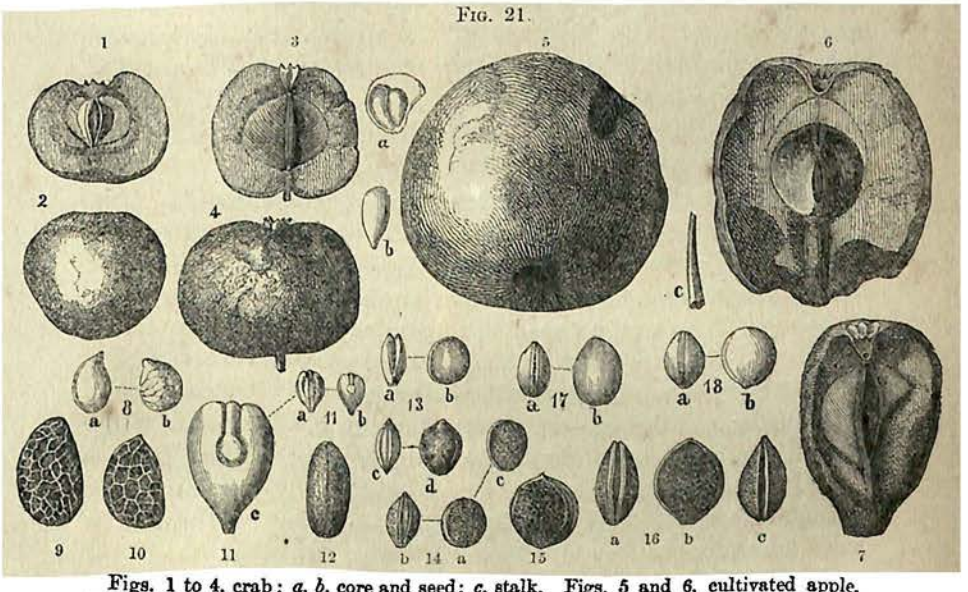
and others had been introduced with the cultivated plants, and been sown with them. The latter were either permanent or mere transitory occupants of the ground. Some are charred, and most unquestionably were mixed with the corn when it was burnt. Others are found in great abundance in the mud, and when the wheat was cleaned, had been thrown into the lake as refuse. A fact of great interest is the occurrence of the Cretan catchfly (*Silene Cretica*, L.), in the remains of the lake dwellings, as it is not found in Switzerland and Germany; but on the contrary, is spread over all the countries of the Mediterranean, and is found in the flax-fields of Greece, Italy, the south of France, and the Pyrenees. The presence of the corn bluebottle (*Centaurea cyanus*) is no less remarkable, for its original home is Sicily. As it had already appeared in the corn-fields of the lake dwellings, it indicates the way by which corn had come into the hands of the colonists.

3. *Culinary Vegetables.*—With the exception of peas, no culinary or garden vegetables can, with any certainty, be mentioned as belonging to the stone age. The Celtic dwarf field beans (*Faba vulgaris*, Mch.), appear in the bronze age of a strikingly small size, such as are never found afterwards. The lentil also (*Ervum lens*, L.) belongs to the variety known as the small or field lentil (*E. lens microspermum*).

4. *Fruit and berries.*—Fruits like apples and pears are found in the lake dwellings, burnt, and in a very fair state of preservation; on the contrary, stone fruit and berries have not been burnt, and therefore only the stones and the hard seed-shells still remain. The apples are chiefly cut into two parts; seldom into three: the smaller ones are left whole. The sour crabs must have been of considerable importance as an article of food, as we may learn from the large quantity of their remains, and their general diffusion amongst the lake dwellings. Together with these wild apples, there were found at Robenhausen a considerable number of a larger kind, which probably were a cultivated variety. Pears must have been less common, for only a few specimens have been found at Wangen and Robenhausen. The fruits of the service-tree have also been found at Wangen and Robenhausen, stones of the cherry—in fact of the sweet cherry—only at the latter settlement. The plum (Robenhausen) is the nearest to the bullace (*Prunus institia avenaria*, Fab.). Sloes were gathered by the colonists, and also bird cherries (*Prunus padus*, L.) in great abundance. Stones of the perfumed cherry (*Prunus Mahaleb*, L.) have been found at Robenhausen and

Parma. Grape-stones are found at Castione, near Parma. Raspberry, blackberry, and strawberry seeds are found, the latter the rarest of the three. The seeds of the dog-rose, the common elder, and the dwarf elder, are met with in abundance. On the other hand the seeds of the bilberry are rare, and the red whortleberry or cowberry does not appear to have been eaten, for only its leaves are found. Stones of the cornel-cherry are met with abundantly at Castione, and the berries of the wayfaring tree occur in several lake dwellings.

FIG. 21.



Figs. 1 to 4, crab; *a*, *b*, core and seed; *c*, stalk. Figs. 5 and 6, cultivated apple. Fig. 7, wild pear. Fig. 8, *a*, strawberry seed magnified; *b*, water crowfoot magnified. Fig. 9, raspberry seed magnified 4 diameters. Fig. 10, seed of the blackberry magnified. Fig. 11, grape-stones, *a*, *b*, natural size; *c*, magnified. Fig. 12, stone of the cornel-cherry. Fig. 13, perfumed cherry (*Prunus Mahaleb*); *a*, *b*, from Castione, near Parma; *c*, *d*, from Robenhausen. Fig. 14, bird cherry (*Prunus padus*); *a*, *b*, round stone from Robenhausen; *c*, rather a long stone, from Concise. Fig. 15, sloe stone. Fig. 16, plum stone; *a*, furrowed ventral side; *b*, broad side; *c*, dorsal furrow. Figs. 17 and 18, cherry stones.

5. *Nuts.*—Beech-nuts are found abundantly; they were probably used as food, and perhaps oil was pressed from them. The walnut was met with at Parma. The waterchestnut (*Trapa natans*, L.) which now only exists in Switzerland in a tarn in the canton of Lucerne, but which is found both at Robenhausen and Moosseedorf, formed doubtless an article of food, as it does at the present day in upper Italy.

6. *Oil-producing plants.*—A whole cake of the seeds of the

garden or opium poppy was found at Robenhausen; probably these seeds were pressed for oil, or they may have been eaten, scattered over the bread.

7. *Aromatic plants.*—The caraway seeds found at Robenhausen were probably used as condiments for the food.

8. *Bast and fibrous plants.*—The flax of the lake dwellings is not the common flax. The small-leaved flax (*Linum angustifolium*, Huds.) which is a native of the countries of the Mediterranean, from Greece and Dalmatia to the Pyrenees, may be considered as the original stock of the cultivated flax of the lake dwellings. The presence of the Cretan catchfly proves that the colonists got their flax-seed from southern Europe. A little flat slab consisting of flax seed, wholly or partially burnt, was found at Robenhausen: possibly it may have been a kind of linseed cake, intended to be eaten by the colonists.

9. *Plants used for dyeing.*—The weld (*Reseda luteola*) may probably have been used for dyeing the linen cloth.

10. *Forest trees and shrubs.*—No great change appears to have taken place in the forest flora since the age of the lake dwellings. It is worth mentioning that at Robenhausen there were found portions of twigs and remains of the leaves of the mistletoe (*Viscum album*), the sacred plant of the Gauls.

11. *Mosses and fern.*—Moss was undoubtedly used for stopping the holes in the walls of the huts, and also for bedding.

12. *Fungi.*—The common tinder fungus (*Feuerschwamm*), which occurs in nearly all the lake dwellings, was probably used for procuring fire.

13. *Water and marsh plants.*—The character of these remains shows us that, at least at Robenhausen, the lake dwellings did not stand on the deep clear lake bottom, but on muddy shallows grown over with vegetation; and also that the growth of peat had already begun on the shore.

RESULTS OF THE INVESTIGATION OF THE LAKE-DWELLING PLANTS.

1. The inhabitants of the lake dwellings do not appear to have had any close connection with the people of eastern Europe, for they, at least in the bronze age, cultivated rye, with which the lake settlers must have become acquainted, if there had been any mutual intercourse. On the contrary, all the cultivated plants show a connection with the countries of the

Mediterranean. Every kind of corn came to them from that quarter. We have seen that the lake colonists cultivated not only the same barley, but even the same variety, as the inhabitants of Southern Italy. According to Pickering, barley appears on the monuments of the Pharaohs of the earliest age, and is found most abundantly in the mummy-cases. We have further seen that a kind of wheat, which still is very commonly cultivated in Egypt, and yet is found in very ancient mummy-cases, came, at least occasionally, into our districts. The Indian millets have also very probably been introduced this way; they were much cultivated in Egypt, and the setaria (*Fennich*) is represented on a tomb of Rameses Sethos, and at El-Kab.

The lake colonists had therefore the same cereals as the Egyptians. They were also clothed in the same manner, for in Egypt flax took the first place amongst the plants used for spinning and weaving. All the mummies are wrapped in linen cloth, and in the time of Herodotus the priest could wear only linen garments. One of the plagues sent by Jehovah upon Egypt was the destruction of their crops of flax and barley by thunder and hail (Exodus ix. 31). The cultivation of flax, and the art of weaving the thread may frequently be seen on the Egyptian mural paintings,* while hemp was unknown as a plant for making thread, and it is also entirely unknown in the remains of the lake dwellings. The garden or opium poppy is, indeed, nowhere drawn on the Egyptian monuments, but, on the other hand, it appears, together with the ear of barley, on a very ancient coin of Smyrna, and also on one of Metapontum; and this plant must have been of some considerable importance amongst the lake colonists, as they probably procured oil from its seeds.

Now, if we take into consideration all these cultivated plants, brought into our districts by man out of the far east; and if we further consider the weeds which, contrary to his inclination, came with them, and of which some (especially the *Centaurea cyanus* and the *Silene Cretica*) also indicate a southern origin, we can hardly hesitate to assert that this agricultural knowledge came into our districts from the basin of the Mediterranean, and that the problematical appearance of celts of nephrite in our lake settlements may have to rank amongst a great number of similar phenomena. The presence of what is called noble nephrite, which is only known in the east, is not more strange

* Sir Gardner Wilkinson's *Manners and Customs of the Ancient Egyptians*, iii. pp. 134, 135, and 138.

than the appearance of the Egyptian wheat, the Cretan catchfly, the oil-yielding poppy, and the glass beads found at Wauwyl, which were either of Egyptian or Phœnician origin. When we speak of Egypt, as we again and again have had occasion to do, we naturally are not thinking of a direct intercourse between the lake colonists and this country; but we simply mean to state that it was the home of that civilisation which spread so widely amongst the regions of antiquity and which had probably extended over the shores of the Mediterranean from Egypt and Phœnicia, and from their colonies had been transmitted further inland, so that from these original centres of the civilisation of that age, some scattered rays may have reached even to our lake dwellings.

2. If this supposition be correct, we may obtain some indications to aid us in determining the age of the lake dwellings. Even if we were ignorant of the absence of metals in the older settlements, we should be obliged from the character of their plants to ascribe to them a very great antiquity. The non-existence of winter corn, of most of the culinary vegetables, and of hemp, as also of the domestic fowl, indicates a period reaching back long before the Christian era. The Greeks and the Romans had winter corn, cultivated hemp, and had a great variety of culinary vegetables. The domestic fowl is nowhere mentioned in Homer or Hesiod, but in the time of Pericles it is spoken of as the Persian bird, and it appears in Italy on coins of Neapolis, probably struck about a hundred years before Christ. To this it must be added, that the Roman authors never mention a word about lake dwellings, and Professor Desor justly reminds us that Pliny had his villa exactly in the place where there are numerous remains of pile dwellings, but which had so completely vanished from the memory of the people that they appeared to have had no suspicion of these ancient inhabitants of the land. On the other hand, according to my judgment, it is going too far, to estimate the age of the lake dwellings at six or seven thousand years—a view taken by M. Morlot. The great number of varieties of corn, which we find even in the stone age, the general cultivation of flax, and all the industrial arts connected with it, and the degree of civilisation attained by the colonists, as exhibited in their remains, have already led us to the conclusion that a long period must have been required for the development of their abilities.

If we look back three thousand years ago, perhaps in the time of Homer or David, we shall find the same cultivated plants

in the east. Barley and wheat are often mentioned in Homer, as well as field beans and poppies, but no mention is made of rye* or of oats. In the book of Ruth, which probably was written in David's time, as it relates to a family history of the royal house, barley and wheat are frequently spoken of; and the reapers of Boaz let Ruth have some of their master's parched corn. Consequently, barley and wheat were the chief kinds of corn in Palestine eleven hundred years before Christ. But they are mentioned, together with the spelt, a good deal earlier, viz., in Genesis, as having undoubtedly in much earlier time laid the foundation of the civilisation which then existed in Egypt.

In David's time (2 Samuel xvii. 28) beans and lentils are spoken of as common food. And the spelt is mentioned elsewhere; but nothing is said of rye or of oats. Together with these, we have the kinds of wheat and leguminous plants which have been found in the lake dwellings of western Switzerland, belonging to the bronze age. At that time bronze appears to have been the metal most generally in use amongst the Orientals and the Greeks. And it is mentioned everywhere in Homer. Bearing in mind the very slow diffusion of civilisation in those ages, the supposition may probably not appear too hazardous, that the lake dwellings where the use of bronze was known may be placed about this period.

But the settlements of the stone age must be earlier; and yet they are so closely connected with those of the bronze age, by such stations as Robenhausen and Meilen, and even the oldest settlements like Wangen and Moosseedorf, both in cultivated plants and in domestic animals, agree so nearly with the others, that no sharp line can be drawn between them, and they cannot probably be further thrown back many thousand years.

3. The lake dwellings were inhabited during the whole year, and the cattle were stalled upon them. The manure which was found at Robenhausen proves the latter proposition, and the undigested remains of food prove the former. The cherry-stones with great probability indicate the month of June; the seeds of

* The English version of Exodus ix. 31, 32, seems to contradict this as far as Egypt is concerned, but from the best authorities, the original word here rendered 'rye' should be translated, 'spelt' as given in the Zürich Bible, and in that of De Wette. Professor Heer states that rye has never been found in the Egyptian monuments, and that the English translation is evidently incorrect, for rye comes *before* wheat, and wheat and spelt also ripen *after* barley. Rye in the Mediterranean countries is cultivated at the present day merely as green food, not as a cereal. Professor Heer adds that 'spelt was actually cultivated in Egypt in the time of the Pharaohs, as is evident from some grains I have received from Professor Ehrenberg, which date from that period.'

raspberries and blackberries the middle and end of summer; the sloes and the seeds of the dog-rose speak of the latter part of autumn or the beginning of winter, when these fruits first become eatable after they have been exposed to the frost; while the hazel-nuts and beech-nuts have reference to autumn and winter; as well as the seeds of weeds grown with the corn and separated from it by the colonists and then thrown into the lake.

4. From Professor Rutimeyer's investigation as to the fauna of the lake dwellings, it appears that at the time of the older settlements of the stone age the wild animals used as food far preponderated over the domestic animals; and that the chase afforded more flesh to the colonists than their herds. But these proportions underwent a change in the bronze age, very favourable to the domestic animals. The great wild oxen, the Urus and the Bison, disappeared, and a great number of new races of horned cattle came upon the scene. (See Rutimeyer's *Fauna der Pfahlbauten*, p. 236.) With respect to plants also, there appears to have been an increase of the cultivated kinds, but even in the oldest known settlements, such as Moosseedorf and Wangen, we have a variety of kinds of corn, as well as the cultivation of flax, consequently, there must have been a knowledge of agriculture. In Robenhausen we find also the cultivation of fruit, and in the age of bronze, that of leguminous plants. However much the wild fruits may have been eaten, yet, from the very first, cultivated plants seem to have afforded the most important articles of vegetable food.

5. Although the actual determination of the age of the lake dwellings is doubtful, yet we may say with perfect certainty that they are more than 2,000 years old; and, with a considerable amount of probability, that they reach back from 1,000 to 2,000 years before Christ. In any case the remains of plants have a very high antiquity, and they throw some light on the solution of the question, whether the species of plants have undergone any change in historic time. With respect to the wild plants, the question must be answered in the negative. The most careful investigation of them shows a surprising agreement with the recent species, and even small varieties of form have been retained, as we see in the water-lily, the fir, the sloe, the bird cherry, and the hazel-nut. Professor Unger has come to the same result by investigating the Egyptian plants. But the case is different with the cultivated plants, although some kinds—as the dense compact wheat (*Binkel-*

weizen) and the close six-rowed barley—have undergone no perceptible change, yet it must be confessed that most of them agree with no recent forms sufficiently to allow of their being classed together. The small Celtic beans, the peas, the small lake-dwelling barley, the Egyptian and the small lake-dwelling wheat, and the two-rowed wheat or *Emmer*, form peculiar, and apparently extinct races: they are distinguished for the most part from the modern cultivated kinds by smaller seeds. Man has, therefore, in course of time produced sorts which give a more abundant yield, and these have gradually supplanted the old varieties.

We have, therefore, to consider the latter as the original stock from which the others have sprung. Thus, probably, the small six-rowed barley of the lake dwellings is the original form from which the four-rowed barley has descended. The axes of the ears have become longer by cultivation, the spikelets are pushed further asunder, and therefore the longitudinal rows lie one over the other. We thus find only four rows on the ears, and the form becomes what is known as common barley (*H. vulgare*). But there was also a change in another direction. In the side florets the pistils do not come to perfection, and consequently only the middle grains are productive. Thus we get only two rows of grains, which consequently become larger. And so by the lengthening of the axes of the ears we get the two-rowed barley (*H. distichum*, L.), but by the shorter axes the 'rice barley' (*H. Zeocriton*, L.). I consider, however, all these forms of barley only as varieties (*Racen*) of one species; in fact, they sometimes exhibit a transition from one to another.

The same thing occurs with the different kinds of wheat. I consider the small lake-dwelling wheat as the primitive form from which have sprung, by cultivation, the different forms, with the axes not fragile and with the grains easily detached, as they all are very near to each other in character, and no important and decisively distinctive marks are to be found between them.*

* The following is the manner in which we should place them: *Triticum vulgare*, Vill. Four-rowed ears, spikelets with 2—4 grains falling out when ripe. Axes not fragile.

a. Triticum antiquorum, M.: Small lake dwelling wheat. Ears awnless, short, the grains very much rounded, small, and closely pressed together; spikelets with 3—4 ripe grains. Palea, sharply carinated on the back from the very bottom, shorter than the glume, and ending in a small tooth.

b. Tr. sativum, Lam.: Common wheat. Ears either with or without awns, spikelets

The flora of the lake dwellings consequently announces to us that all the plants which come in contact with man (*welche des Menschen Hand berührt*) become changed *up to a certain point*, and thus man participates in the great transformations (*Umbildungsprozesse*) of nature, while the wild plants which surround us at the present day still grow in the same forms (*in denselben Formen sich bewegen*) as they did three or four thousand years ago, and do not exhibit the smallest change.

CATALOGUE OF PLANTS.

1. CEREALS.—Small lake-dwelling barley (*Hordeum hexastichum sanctum*). Compact six-rowed barley (*Hordeum hexastichum densum*). Two-rowed barley (*Hordeum distichum*, L.). Small lake-dwelling wheat (*Triticum vulgare antiquorum*, M.). 'Binkel-weizen' or beardless compact wheat (*Triticum vulgare compactum muticum*). Egyptian wheat (*Triticum turgidum*, L.). Spelt (*Triticum spelta*, L.). 'Emmer,' or two-grained wheat (*Triticum dicoccum*, Schrank). One-grained wheat, or 'Einkorn' (*Triticum monococcum*, L.). Rye (*Secale cereale*, L.). Oat (*Avena sativa*, L.). Millet (*Panicum miliaceum*, L.). Italian setaria, 'Kolbenhirse,' or 'Fennich' (*Setaria Italica*, L. sp.).

2. WEEDS OF THE CORN-FIELD.—Darnel (*Lolium temulentum*, L.). White goosefoot (*Chenopodium album*, L.). Many-seeded goosefoot (*Chenopodium polyspermum*, L.). Red goosefoot (*Chenopodium rubrum*, L.). Striped-seeded goosefoot.* Burdock (*Lappa major*, L.). Corn cockle (*Agrostemma githago*, L.). White campion (*Lychnis vespertina*, L.). Cretan catchfly (*Silene Cretica*, L.). Chickweed (*Stellaria media*, L. sp.). Smooth-seeded spurry, *Spergula pentandra*, L.). Thyme-leaved sandwort (*Arenaria serpyllifolia*, L.). Goosegrass (*Galium aparine*, L.). Creeping

with 2—3 ripe grains. Palea nearly of the length of the glume, carinated only in front. Grains, a long oval, blunt.

c. Tr. durum, Desf.: Hard wheat. Ears awned, spikelets with 3—4 grains. Palea narrow, as long as the glume; sharply carinated from the bottom, ending in a broad curved tooth.

d. Tr. turgidum, L.: Egyptian wheat. Ears awned; spikelets with 2—3 grains. Palea inflated, broad, shorter than the glume, sharply carinated on the back, ending in a short tooth; grains large, much rounded, ovate.

These 'races' again are subdivided into numerous sub-races.

* This seed is drawn Plate LXXXVII. fig. 41. From Professor Heer's account it seems almost peculiar to the lake dwellings. Under the microscope there are numerous radiating bands, or stripes, very close together, and partially interrupted.

crowfoot (*Ranunculus repens*, L.). Little bur medick (*Medicago minima*, L.). Corn bluebottle (*Centaurea cyanus*, L.).

3. Culinary Vegetables.—Parsnep (*Pastinaca sativa*, L.). Common carrot (*Daucus carota*, L.). Celtic fieldbean (*Faba vulgaris*, Mch.; *Celtica nana*). Pea (*Pisum sativum*, L. var.). Lentil (*Ervum lens*, L.).

4. Fruit and Berries.—Apple (*Pyrus malus*, L.); *a*, smaller crab; *b*, larger round lake-dwelling apple. Pear (*Pyrus communis*, L.). Service-tree (*Pyrus aria*, L.). Cherry (*Prunus avium*, L.). Bullace (*Prunus institia*, L.). Sloe (*Prunus spinosa*, L.). Bird cherry (*Prunus padus*, L.). Perfumed cherry (*Prunus Mahaleb*, L.). Vine* (*Vitis vinifera*, L.). Raspberry (*Rubus idœus*, L.). Bramble (*Rubus fruticosus*, L.). Strawberry (*Fragaria vesca*, L.). Dog-rose (*Rosa canina*, L.). Common elder (*Sambucus nigra*, L.). Dwarf elder (*Sambucus ebulus*, L.). Bilberry (*Vaccinium myrtillus*, L.). Red whortleberry or cowberry (*Vaccinium vitis idœa*, L.). Cornel-cherry (*Cornus mas*, L.). Wayfaring tree (*Viburnum Lantana*, L.).

5. Nuts.—Hazel-nut (*Corylus avellana*, L.). Beech (*Fagus sylvatica*, L.). Walnut (*Juglans regia*, L.). Waterchestnut (*Trapa natans*, L.).

6. Oil-producing Plants.—Opium or garden poppy (*Papaver somniferum*, var. *antiquum*, L.). Dogwood (*Cornus sanguinea*, L.).†

7. Aromatic Plants.—Caraway (*Carum carui*, L.).

8. Bast and fibrous Plants.—Flax (*Linum angustifolium*, Huds.). Lime-tree (*Tilia grandifolia*, Ehrh.). Small-leaved lime-tree, (*Tilia parvifolia*, Ehrh.).

9. Plants used for dyeing.—Weld (*Reseda luteola*, L.).

10. Forest Trees and Shrubs.—Scotch fir (*Pinus sylvestris*, L.). Mountain pine (*Pinus montana*, Mill.). Spruce fir (*Pinus abies*, L.). Silver fir (*Pinus picea*, L.). Juniper (*Juniperus communis*, L.). Yew (*Taxus baccata*, L.). Oak (*Quercus robur*, L.) Hornbeam (*Carpinus betulus*, L.). Alder (*Alnus glutinosa*, L.) Birch (*Betula alba*, L.). Willows (*Salix repens* and *Salix cinerea*.) Ash (*Fraxinus excelsior*, L.). Mistletoe (*Viscum album*, L.). Holly (*Ilex aquifolium*, L.). Spindle-tree (*Euonymus Europœus*, L.). Berry-bearing alder (*Rhamnus frangula*, L.) Maple (*Acer*). Mountain ash (*Sorbus aucuparia*, L.).

* Professor Heer looks on the grape-stones from Wangen with suspicion, because they are like those of the modern grapes, and they are not burnt; but this is also the case with the seeds of the bramble and the strawberry. The grape-stones from Castione he considers genuine, as they agree with those of the wild blue grape.

† The kernels of dogwood seeds contain a rich oil, which may be pressed out.

11. Mosses and Ferns.—Mosses: *Antitrichia curtipendula*, Dill. sp.; *Neckera complanata* and *N. crispa*, Dill.; *Thuidium delicatulum*, L. sp.; *Anomodon viticulosus*, Dill.; *Leucodon sciuroides*, Dill.; *Hylocomium brevirostre*, Ehrh. Fern: *Pteris aquilina*, L.

12. Plants for procuring Fire.—Common tinder-fungus (*Polyporus igniarius*, L.); *Polyporus fomentarius*, L. Oak agaric (*Dædalia quercina*, L.).

13. Water and Marsh Plants.—Chara (*Chara vulgaris*, L.; *Ch. fœtida*, A. Br.). Common reed (*Phragmites communis*, L.). Lake scirpus (*Scirpus lacustris*, L.). Sedges (*Carices*). Marsh Scheuchzeria (*Scheuchzeria palustris*, L.). Yellow flag (*Iris pseudacorus*, L.). The pondweeds (*Potamogeton perfoliatus*, L.; *P. compressus*; *P. natans*, L.; *P. fluitans*, Roth.). Common hornwort (*Ceratophyllum demursum*, L.). Water plantain (*Alisma plantago*, L.). Water pepper (*Polygonum hydropiper*, L.). Marsh bedstraw (*Galium palustre*, L.). Buckbean (*Menyanthes trifoliata*, L.). Marsh lousewort (*Pedicularis palustris*, L.). Marsh pennywort (*Hydrocotyle vulgaris*, L.). Hog's fennel (*Peucedanum palustre*, L.). White water-lily (*Nymphæa alba*, L.). Yellow water-lilies (*Nuphar luteum* and *N. pumilum*?). Watercrowfoot (*Ranunculus aquatilis*, L.; *R. hederaceus*, L.; *R. flammula*, L.; *R. lingua*, L.).

EXPLANATION OF THE FIGURES IN PLATES LXXXVII. AND LXXXVIII.

N.B. Figs. 1 to 44 are on the First; Figs. 45 to 107 on the Second.

Figs. 1–8, small lake-dwelling barley (*Hordeum hexastichum sanctum*). Figs. 1, 2, 3, ears from Robenhausen. Figs. 2 and 3 are placed so that the three grains may be seen which stand in one of the hollows of the axis. The three rows of grains, therefore, here seen, belong to one side of the axis, while the other side with its three rows lies behind. Fig. 1 is the drawing of an ear (perfect as far as the length is concerned), given in a different view, for the first and second row, reckoning from the left, belong to two sides of the ear, and in the upper, or most perfect portion, four rows may be seen. Fig. 4, single grains; *a* and *d* from the outside, with the germ; *b*, *c*, from the inside. Fig. 5, from Wangen. Fig. 6, *a*, *b*, *e*, *f*, from Peter's Island; *c*, *d*, from Montellier. Fig. 7, grain surrounded by

both the glumes. Fig. 8, axis from which most of the grains have fallen off; it shows the places where the spikelets join on to it, and also how closely they are arranged. Fig. 9, compact six-rowed barley (*Hordeum hexastichum densum*). Fig. 9, portion of an ear from Robenhausen. Fig. 9, *b*, *c*, *d*, single grains, both from the front and the back. Figs. 10 to 13, ancient Italian silver coins. The six-rowed barley is excellently delineated on the most ancient coins of Metapontum, about the sixth century B.C., Fig. 10, and still more accurately represented on those of the fifth century B.C., Figs. 11 and 12. On many of these coins a locust (*Acridium migratorium*, L.), is sitting on the ear, while on the reverse is Apollo, the god who protects the barley-field from the dreaded plague of locusts. The coin, Fig. 12, represents the mouse, together with the ear of barley, and on the reverse is Ceres, the protectress of agriculture, with ears of the same kind of barley plaited in her hair. * The sparrow also, that constant attendant upon all cereal operations, is not absent; nay, even the destructive wheat-fly (*Cecidomyia destructor*) is quite easily recognised upon the ears of barley. On the coins of Leontinon, Fig. 13, an ancient Sicilian town, only single grains of barley are represented, with the lion's head; they agree with those of the small lake-dwelling barley, the ancient type of the sacred barley. Figs. 14-18, small lake-dwelling wheat (*Triticum vulgare antiquorum*, M.). Fig. 14, portion of an ear from Robenhausen. Fig. 15, a second portion seen from the inside, showing the close arrangement of the spikelets. Fig. 16, a single spikelet with four grains. Fig. 16 (below), glume, very much magnified. Fig. 17, the ear completed. Fig. 18, single grains; *a*, *b*, *c*, *e*, *f*, *g*, from Robenhausen; *aa*, from Moosseedorf; *d* from Montellier; *h* from Olmütz. Fig. 19, 'Binkelweizen,' or beardless compact wheat (*Triticum vulgare compactum muticum*); 19, *a*, spikelet with three grains; *b*, *c*, from Robenhausen; *f*, out of a piece of bread; *d*, *e*, from Buchs; *g*, *h*, from Peter's Island; *i*, from Parma. Fig. 20, Egyptian wheat (*Triticum turgidum*, L.), whole ear from Robenhausen. Fig. 21, grains from this ear; *a*, front; *b*, back with the germ; *c*, section; *d*, glume. Fig. 22, spelt (*Triticum spelta*, L.), from Peter's Island; *a*, spikelet, with the

* Even in these small ears, as well as those equally small upon the Campanian coins (together with the horse's head), the artist knew how to give the character of the sacred barley, while on modern coins, such as those of the French Republic of 1848, no mortal can say whether the ears are intended to represent those of barley, or wheat, or rye.

glume; *b*, *c*, *d*, *e*, grains. Fig. 23, lake-dwelling 'Emmer' (*Triticum dicoccum*, Schrank), from Wangen, whole ear; 23, *b*, side view of a portion of it. Fig. 24, Oat (*Avena sativa*, L.). Fig. 24, *a*, *b*, from Buchs; *c*, from Montellier; *d*, *e*, from Peter's Island; *f*, from Wismar, in Mecklenburg. Fig. 25, rye (*Secale cereale*, L.), from Olmütz; *b*, *c*, back view with the germ; *a*, front; *d*, section. Fig. 26, millet (*Panicum miliaceum*, L.), from Wangen; *b*, glume magnified. Fig. 27, *a*, *b*, *c*, single grains from Montellier magnified. Fig. 28, Italian setaria (*Setaria Italica*, L.), from Montellier. Fig. 29, two grains magnified; *a*, *b*, from Buchs. Fig. 30, Cretan catchfly (*Silene Cretica*, L.) capsule, from Robenhausen. Fig. 31, seeds of this plant from the same place; *a*, magnified; *b*, back of the seed; *c*, some of the little projections very much magnified. Fig. 32, corn-cockle (*Agrostemma githago*, L.), from Robenhausen. Fig. 33, white campion (*Lychnis vespertina*, L.), magnified two diameters, from Robenhausen. Fig. 34, Sandwort (*Arenaria serpyllifolia*, L.), magnified, from Moosseedorf. Fig. 35, goosegrass (*Galium aparine*, L.); *a*, *b*, from Montellier. Fig. 36, burdock (*Lappa major*, L.), from Robenhausen. Fig. 37, corn bluebottle (*Centaurea cyanus*, L.), from Robenhausen, magnified. Fig. 38, spurry (*Spergula pentandra*, L.), from Robenhausen, magnified. Fig. 39, creeping crowfoot (*Ranunculus repens*, L.), magnified two diameters. Fig. 40, white goosefoot (*Chenopodium album*, L.); *a*, natural size; *b*, *c*, magnified; *d*, still further magnified; *e*, back view. Fig. 41, striped-seeded goosefoot; *a*, magnified three diameters; *b*, very much magnified. Fig. 42, darnel (*Lolium temulentum*, L.); *a*, *b*, natural size; *c*, magnified. Fig. 43, parsnep, (*Pastinaca sativa*, L.); *a*, outside of the seed; *b*, magnified three diameters; *c*, inside magnified; from Moosseedorf. Fig. 44, Celtic field-bean (*Faba vulgaris Celtica*, M.), from Montellier. Figs. 45, 46, from Peter's Island. Fig. 47, from Castione, near Parma. Fig. 48, pea (*Pisum sativum*, L. var.), from Peter's Island. Fig. 49, lentil (*Ervum lens*, L.); *c*, back view, Peter's Island. Fig. 50, service-tree (*Pyrus aria*, L.), seed from Robenhausen. Fig. 51, dog-rose (*Rosa canina*, L.), seed magnified, from Robenhausen. Fig. 52, elder (*Sambucus nigra*, L.), seed magnified, from Robenhausen. Fig. 53, dwarf elder (*Sambucus ebulus*, L.), seed, magnified two diameters, from Robenhausen. Fig. 54, bilberry (*Vaccinium myrtillus*, L.), seed magnified, from Robenhausen. Fig. 55, wayfaring-tree (*Viburnum lantana*, L.), from Robenhausen. Figs. 56–60, Hazel-nut (*Corylus avellana*, L.).

Fig. 56 (*C. avellana*, L.), and Fig. 57 (*C. avellana ovata*, W.), bored by the nut-beetle, from Robenhausen. Fig. 58, from Parma. Fig. 59, double or chance nut. Fig. 60, nut bitten by a mouse, from Moosseedorf. Fig. 61, leaf, from Moosseedorf. Fig. 62, beech-nut (*Fagus sylvatica*, L.), from Moosseedorf. Fig. 63, covering of the beech-nut, from Robenhausen. Fig. 64, water chestnut (*Trapa natans*, L.), from Robenhausen. Fig. 65, garden or opium poppy, young heads or seed vessels, charred, from Robenhausen; *a*, upper view; *b*, side view. Fig. 66, seeds; *a* (natural size), a small piece of the poppy cake; *b*, poppy seed, magnified four diameters, from Robenhausen. Fig. 67, dogwood (*Cornus sanguinea*, L.); *a*, nut or seed; *b*, section; from Robenhausen. Figs. 68–77, lake-dwelling flax (*Linum angustifolium*, Huds.) Figs. 68–71, burnt capsules; 69 from below, 68 from above. Figs. 70–71, side view. Fig. 72, unburnt capsule, from Robenhausen. Fig. 73, seeds out of this capsule; *b*, magnified. Fig. 74, unburnt seed, from Moosseedorf; *a*, *b*, natural size; *c*, magnified two diameters. Fig. 76, portion of a linseed cake, from Robenhausen. Fig. 77, stalk of the flax plant; *a*, lower part; *c*, *d*, upper part, showing the places of attachment of the smaller branches; *e*, *f*, with thin twigs, to which probably the capsules were attached. Figs. 78–80, fruit of the lime tree. Fig. 78, with four carpels. Fig. 79, with five. Fig. 80, split into five flaps, all of the *Tilia parvifolia*, Ehrh. Fig. 81, weld (*Reseda luteola*, L.), very much magnified; Robenhausen. Fig. 82, Scotch fir (*Pinus sylvestris*, var.); *b*, single scale, side view, from Robenhausen. Fig. 83, mountain pine (*P. montana*, Mill.), from Robenhausen; *c*, scale, side view; *b*, seed, from Robenhausen. Fig. 84, silver fir (*Pinus picea*, L.); *a*, *b*, needle-shaped leaves, from Robenhausen. Fig. 85, juniper (*Juniperus communis*, L.), cone, from Robenhausen. Fig. 86, yew (*Taxus baccata*, L.); *a*, *b*, seed, natural size; *c*, magnified; from Robenhausen. Figs. 87-90, oak (*Quercus robur*, L.). Fig. 87, acorn cup, from Robenhausen. Figs. 88, 89, burnt acorns, from Peter's island. Fig. 90, burnt acorn, from Parma. Fig. 91, hornbeam (*Carpinus betulus*, L.), seed, seen from the front and the back, *a*, *b*. Fig. 92, mistletoe (*Viscum album*, L.), portion of a branch, Moosseedorf. Fig. 93, lake scirpus (*Scirpus lacustris*, L.), from Robenhausen; magnified. Fig. 94 (*Potamogeton perfoliatus*, L.), from Robenhausen; magnified. Fig. 95 (*P. compressus*, L.), from Robenhausen. Fig. 96, common hornwort (*Ceratophyllum demersum*, L.), from Robenhausen. Fig. 97, marsh bed-

straw (*Galium palustre*, L.); *a*, natural size; *b*, *c*, magnified. Fig. 98, very much magnified; from Robenhausen. Fig. 99, buckbean (*Menyanthes trifoliata*, L.); *a*, *b*, *c*, slightly magnified; Robenhausen. Fig. 100, marsh lousewort (*Pedicularis palustris*, L.), seed, magnified. Fig. 101, yellow water-lily (*Nuphar luteum*, L.), Robenhausen. Fig. 102, small yellow water-lily (*Nuphar pumilum*, Sm.); *c*, from above, magnified; Robenhausen. Fig. 103, white water-lily (*Nymphæa alba oocarpa*), magnified two diameters; Robenhausen. Fig. 104, white water-lily with small seeds; magnified two diameters; Robenhausen. Fig. 105 (*Scheuchzeria palustris*, L.), magnified two diameters; Robenhausen. Fig. 106, lesser spearwort (*Ranunculus flammula*, L.), magnified three diameters. Fig. 107, ivy-leaved crowfoot (*Ranunculus hederaceus*, L.), magnified; Robenhausen. Fig. 108, marsh pennywort (*Hydrocotyle vulgaris*, L.), magnified two diameters; Robenhausen.

RESULTS OF THE INVESTIGATION OF ANIMAL REMAINS FROM THE LAKE DWELLINGS,

By Professor Rütimeyer, of Basle.

The results of my earlier labours have in their essential parts been quite confirmed, and in many points completed, by the investigations lately carried on; and besides this, some quite new and interesting species of animals have been discovered. The chief point, however, was more especially to follow out the fauna of the lake dwellings in a descending line, in order to ascertain its relation to the fauna of the present day; and in this retrospective view the domestic animals seemed of the first importance, the historical changes in the department of wild animals being of a far simpler nature.

All these results are the objects of an especial work, illustrated with drawings, and which gives the existing state of our knowledge as to the wild and domesticated animals of the lake dwellings, as well as the changes they have undergone in the course of time up to the present day.* I will, however, in this short report, gladly refer to one or two points in this work which may be interesting not only to the zoologist, but also to the antiquary.

It was to be expected that the smaller animals—the birds, the fishes, and the little mammalia—would form the chief additional contribution to our earlier list of animals. With respect to fishes, many species were found which are now the most abundant in our lakes and rivers, and also a large number of birds which would form just such a flock as may be seen at the present day in the wild and well-wooded marshy places of our own country. To the birds of prey already known to have been common, as

* Die Fauna der Pfahlbauten in der Schweiz, Untersuchungen über die Geschichte der wilden und Haus-Säugethiere Mitteleuropas. Mit Holzschnitten und 6 Tafeln Abbildungen. Basel, 1861.

well as the herons and ducks, we may now add the golden eagle, the osprey, the stork and the swan, the wild goose, the gull, the black water-hen or coot, and the black cock. The presence of the swan, which only appears on our lakes in very cold winters, in the months of December and January, is peculiarly interesting, as it proves that the lake dwellings were not abandoned in the most severe winter weather, when even our larger lakes are often frozen over for a length of time.

Not a single trace of the domestic fowl has yet been found amongst the lake dwellings; one single bit of bone of the common hen found at Morges hardly deserves to be mentioned, as it was found in an open lake, and besides this, had a very suspicious appearance.

The little animals which are so inconvenient in our modern houses, rats and mice, do not seem to have troubled the inhabitants of the lake dwellings, so that they could the more easily do without cats, of which no remains whatever are found. The only bone of a mouse yet found belongs to the field-mouse, which never lives in houses. For the first time, we find at Moosseedorf and Robenhausen traces of the hare.

The late additions to the list of great mammalia are naturally smaller in number. Amongst them, however, are the ibex and the chamois, and two domestic animals, viz. the ass, and at Concise and Chevroux a very large ox with great semilunar horns bent forwards from the frontal plane: this animal has hitherto only been known in a fossil condition in the diluvium of Italy, and was contemporaneous with the mammoth and the hippopotamus. At Concise and Chevroux this ox with curved horns can positively be proved to have been domesticated; it was nearly as large as the urus.

The last-named animal as well as the bison (or wisent) were at first considered as rather rare, but now they are found to have been the most abundant animals in the forests of the stone age; we ought, however, to state that at Concise they entirely disappeared with the introduction of metal weapons. From this time forward in general, all game or wild animals which in early ages far preponderated in number over the domestic animals, began to decline in a most marked manner, and became of second-rate importance. From several specimens, the urus is now proved to have existed not only at Moosseedorf and Robenhausen, but also at Wauwyl and Concise: at Robenhausen there were a number of specimens. I only as yet know of the bison at Wauwyl and Robenhausen, but at the latter place there are at least half a dozen specimens of different ages.

Though the urus became extinct at an early period, together with the aurochs or bison—for we will not assume that it gradually withdrew out of Switzerland to its present abodes—yet it has left abundance of traces behind it. One of the most important and surest results of the investigations, as far as they have gone, consists in showing that the urus lived in Switzerland at the same time, in the stone age, both wild and also as a domestic animal which had been long tamed. We cannot venture to conclude that it was first domesticated at this period, for at Moosseedorf and Robenhausen it had already, like the bos trochoceros just referred to from the lake of Neuchâtel, lost much of the size of its wild ancestors and contemporaries, either by crossing with a smaller breed, or, what is more probable, by scanty food, for we find that the same domestic cattle, when well fed, again attain at the present day to the giant size of their ancestors, who are far removed from them in time. It is remarkable, however, that this domestic animal is no longer found in Switzerland, but only on the marshes of the coasts of the North Sea. No trace of bos trochoceros can be found amongst our present races of cattle.

One race we have already, on sure grounds, named the 'marsh cow.' With those just mentioned it completes the series. It lived in the stone age, was most abundant in the older settlements, and has lasted up to the present day in the greater part of Switzerland. It is allied to what is called at the present day the brown cow, which almost exclusively occupies the whole mountainous part of Switzerland, and in many wild mountain valleys does not exceed the size of the small race from which it has sprung. This race of cattle seems to warrant an assumption as to the colour of the marsh cow of the stone age.

The pig is another domestic animal of which several races were found very early. Yet, as far as I can make out, it did not occur tame in the oldest settlements of the stone age; but, on the contrary, there were then two races of wild swine, which might almost be called species—one the wild boar of the present day, and the other what I have designated as the marsh swine. I find the first traces of wild swine at Robenhausen, Meilen, and Concise, consequently about the time when metals first came into the possession of the colonists. In fact, the marsh pig was first found in a tame state, and then, still later, at Concise and at the Thièle, the wild boar. A third race is found at Morges, still smaller than the first, and, from all appearance, partly of foreign origin, like the bos trochoceros.

From this period also the races of dogs and sheep increase, and gradually complete the present series of domestic animals. This is not the place to enter into an exact description of these races, their probable origin, and their representatives at the present day. Half of the work already referred to, 'The Fauna of the Lake Dwellings,' is devoted to this historic sequence of the domestic animals, and enters into the subject as fully as can be done at present; the difficulty of the investigation, however, leaves ample room for completion at some future time.

I will only, in conclusion, refer to two unexpected results, which are remarkable on many accounts. In the first place, I cannot find all through the whole period of lake dwellings one very notable domestic animal which at the present day is of the greatest importance in Switzerland amongst all its contemporaries, and which is of the first economic value. I refer to the great spotted cow (Fleckvieh), as it is called, of Northern and Western Switzerland, coloured black and white or red and white, the purest breeds of which are known under the names of the Freiburg and the Simmenthal-Saanen breeds. The very striking osteological characters of this race, which enable us to trace it back to a peculiar original stock, quite as well as the three other races of domestic cattle of the lake period, leave us without any doubt on the point. This breed is not found during the whole period of the lake dwellings, and first makes its appearance at a very late period, apparently about the time when the great Primigenius race of the stone age gradually became extinct in Switzerland, or retreated from that country. One single locality, and that not a lake dwelling, viz., Steckborn, on the lake of Constance, has afforded, together with the last representatives of the earlier epoch, the first traces of this new and most important representative of the present age.

And yet we cannot say exactly the very last representatives of the earlier period, for in that case the brown cow would have been specified, which is spread over such an extent of ground, and which has continued almost unchanged from the earliest times in which we have any traces of civilisation, down to the present day; in fact, this is almost the only inheritance we have received from those early ages. It is only in a most remote corner of our Alps, in the background of the 'Vorder Rhein,' that in a very singular manner we meet with remains of the olden time of a somewhat similar nature, such as the sheep of the stone age, and the last remnant of the marsh swine, though with the characters much obliterated and changed. It is a

matter of no small importance that a race of men live in the same districts who, besides using an old dialect which for the most part has disappeared long since from other parts of Switzerland, bear in the shape of their skull the stamp of a much earlier age.

And it is here, in the study of man himself, that doubtless is to be found the key of many of the existing difficulties, and the material for filling up many gaps still left in the investigation of the animal world. The facts to enable us to commence this part of the task are gradually increasing, and we may venture to hope that the anatomical investigation of the human and animal remains will, at no great distance of time, mutually complete and control each other.

These notices on some of the more essential parts of the results of the late investigations may probably be sufficient for the present volume. I cannot, however, in conclusion, refrain from expressing my conviction that even the oldest lake dwellings do not by any means exhibit to us the primitive population of our country. I must, indeed, regard them as 'autochthones,' or at least as very ancient inhabitants of these districts, for they possessed as domestic animals a number of those which undoubtedly were indigenous here, particularly the urus and the marsh swine; but the fact, that from the beginning they had the sheep and the dog, the indigenous origin of which is, to say the least, highly improbable, indicates their having descended from a still earlier people. For my own part, therefore, I have little doubt of the existence at one time of a genuine primitive population throughout Europe. This appears to have been proved, as far as France is concerned, by the latest discovery in Aurignac.*

This seems to be the first place where we can no longer strive against the evidence of a European population who used as food not only the urus and the bison, but also the mammoth and the rhinoceros, and who left the remains of their feasts not only to be gnawed by the wolf and the fox, but also by the tiger and the hyæna. It is, in truth, an old psychological experience, that we always consider that to be really primitive which we see the farthest removed from us, and this in spite of numerous admonitions which are continually pointing out to us stations lying further and still further behind. The investigation of the commencement of human history will hardly have

* See the 'Société philomathique de Paris.' Extrait de la Séance du 18 mai 1861.

the prerogative of being liberated from the gradual advance which palæontology has followed up. The discovery at Aurignac places the age of our lake dwellings at a comparatively late period, although almost immediately under our peat beds, with their rich treasures, similar antiquities are found; nay, still older remains are met with only a little deeper (in the slaty brown-coal of Dürnten, perhaps forty feet under the bed of the lake of Pfäffikon) than those of Aurignac, which have there been gnawed by hyænas, after having been despoiled of their marrow (like the bones of Robenhausen) by human hands. This last fact would also point out to us the place where we have to look for the remains of the ancestors of the lake settlers, namely, *under* the glacier moraines; for it is manifest that the people who inhabited the grotto of Aurignac were older than the extension of the glaciers, and consequently also witnesses of this mighty phenomenon. But this fact, on the other hand, takes from us every hope of still finding traces of human existence on places over which the ancient glaciers have passed. Examples showing this in later times are by no means wanting in our country. At all events the last gap between geological and historical time is now filled up by the discovery at Aurignac.

To the above remarks of Professor Rütimeyer it will be well to append a complete list of the animals found in the lake dwellings. To those who have read the previous pages, it will hardly be necessary to remark that the names of many of the localities are given abridged. Thus: Rob. signifies Robenhausen; Mei., Meilen; Moos., Moosseëdorf; Wang., Wangen; Wauw., Wauwyl; and Con., Concise. Some slight alterations have been made by Professor Rütimeyer within the last few weeks.

Ursus arctos . . .	Rob., Mei., Moos., Wang., Con., Neuville.
Meles vulgaris . .	Rob. *et passim.*
Mustela foina . .	Rob. and all stations of the stone age.
„ martes . .	Rob., Wauw., Moos., Mei., Con.
„ putorius . .	Rob., Wauw., Moos., Con.
„ erminea . .	Wauw.
Lutra vulgaris . .	Rob., Moos.
Canis lupus . . .	Rob., Mei., Wang., Wauw., Con., Zihl. (teeth as trophies of the chase: only a few bones).

Canis vulpes	Rob. *et passim.*
„ familiaris	Rob., Mei., Moos., Wauw., Wang., Con., Bienne.
„ fam. major	Only in the Western Lakes.
Felis catus	Rob., Moos., Wauw.
Erinaceus Europæus	Rob., Moos., Wauw.
Castor fiber	Rob. and all stations of the stone age.
Sciurus Europæus	Rob., Moos., Wang., Wauw.
Mus sylvaticus	Rob.
Lepus timidus	Rob., Moos.
Sus scrofa ferus	Rob. *et passim.*
„ domesticus	Wauwyl and the Western Lakes.
„ palustris ferus ?	Rob., Mei., Moos., Wang., Wauw., Con.
„ „ domesticus	Rob., Mei., Moos., Wang., Wauw., Con., Bienne.
Equus caballus	Rob. *et passim.*
„ asinus	Wauw.
Cervus alces	Rob., Mei., Moos., Wauw., Möringen, Con., Bienne.
„ elaphus	Rob. *et passim.*
„ capreolus*	Rob. *et passim.*
Capra ibex	Meil.
„ hircus	Rob., Moos., Wauw., Con., Bienne.
Ovis aries	Rob., Moos., Wauw., Mei., Con., Bienne.
Antilope rupicapra	Rob.
Bos primigenius	Rob., Moos., Wauw., Con.
„ bison	Rob., Wauw.
„ taurus primigenius	Rob., Moos., Mei., Con., Bienne.
„ „ brachyceros	Rob. *et passim.*
„ „ trochoceros	Con.
„ „ frontosus	Bienne.
„ „ domesticus	*Passim.*

Aquila fulva	Rob.
„ haliætus	Moos.
Falco milvus	Rob.
„ palumbarius	Moos., Wauw
„ buteo	Rob.
„ nisus	Moos.
Strix aluco	Con.
Sturnus vulgaris	Rob.
Corvus corax	Rob.
„ corone	Rob.
Cinclus aquaticus	Rob.

* Cervus dama was at one time thought to have left its remains in the lake dwellings; but Professor Rütimeyer has determined otherwise.

Columba palumbus	Rob., Moos.
Tetrao bonasia	Rob.
Ciconia alba	Rob., Moos.
Ardea cinerea	Rob.
Grus cinerea	Rob.
Fulica atra	Rob.
Larus, sp.	Rob.
Cygnus olor	Rob.
Anser segetum	Rob.
Mergus merganser	Rob.
Anas boschas	Rob., Moos., Wang.
„ querquedula	Rob., Moos.
Podiceps minor	Rob.

Cistudo Europæa	Moos.
Rana esculenta	Rob., Moos., Wauw.
„ temporaria	Rob.
Bufo vulgaris	Rob.

Salmo salar	Moos.
Esox lucius	Rob., Moos., Wauw., Nidau St., Con.
Perca fluviatilis	Rob.
Cyprinus carpio	Rob., Moos.
„ leuciscus	Rob., Moos.
„ dobula	Rob.
Chondrostoma nasus	Rob.
Lota vulgaris	Rob.
Scardinius erythrophthalmus	Rob.

CHEMICAL ANALYSIS OF THE BRONZE IMPLEMENTS,

By Professor L. R. von Fellenberg, of Berne.

The analysis of the bronze implements found in Switzerland and the neighbouring countries, which was undertaken by M. von Fellenberg at the request of Professor von Morlot, is of great interest. The results of these investigations were published by M. von Fellenberg in the Transactions of the Natural History Society of Berne, in the years 1860 and 1861. It appears from this communication that the bronze of many of the weapons and implements discovered in the western part of Switzerland consists of pure tin mixed with copper in which there is a little nickel; while not a trace of this metal is to be found in bronze objects met with elsewhere. As mines of copper and nickel, which last are worked at the present day, are found close together in the vale of Anniviers, in the Valais, M. von Fellenberg conjectures that the copper of the implements containing nickel has come from the Valais. In the second report he makes the following observations:—'The drop-shaped refuse from the crucibles, and the lines showing the joining of the two sides of the mould, found in many places on the implements, both of bronze and copper, lead us to conclude that they were actually manufactured and cast on the very spots where they were found —as, for instance, Tschugg, Estavayer, and Echallens, and that they were made out of tin obtained by commerce, and copper brought from the neighbouring district of the Valais.

'According to the small assay of ancient tin which I have been able to make, it may be considered as pure, for there was only a trace of iron, and no other metallic ingredient. It consequently follows that, especially in Cornwall, which probably in ancient times supplied the tin, that was preferred which was made out of what is called stream tin, by being repeatedly washed and then melted in a furnace.'

FOR COMPARISON.

SETTLEMENTS OF THE SAME PEOPLE ON THE MAINLAND.

I. SETTLEMENT AT EBERSBERG.

It must be a matter of the greatest interest, after we have been examining all the rich stores of antiquities obtained during the last few years from the lakes of Switzerland and the adjoining countries, to enquire whether any settlements have been observed on the mainland, the antiquities of which correspond with those of the lake dwellings, and thus throw some light on both descriptions of settlement.

The reply to this question is, that there are several localities of this nature; amongst which may be mentioned Ebersberg, near Berg, on the Irchel; Burg, near Vilters; Uetliberg, and Windisch.

The place named first is of especial interest, as it has been examined, excavated, and reported on by Mr. G. von Escher von Berg, first in 1851, and subsequently in 1862. Numbers of antiquities have been found there, and it appears in fact to be a settlement on the mainland agreeing with the lake dwelling of Nidau-Steinberg, both as to the civilisation of its inhabitants and the period of its existence: it agrees also in general with all those settlements which were founded in the stone age, and continued inhabited till the bronze age, but were abandoned before iron came into common use. The stone celts, flint knives, what are called corn-crushers, tools of horn and bone, as well as the implements and ornaments of bronze, all appear perfectly identical with the antiquities of the lake dwellings on both sides of the Alps. And in the presence of this fact, the correctness of the conclusion cannot be doubted in the slightest degree, that the settlements of the same people who erected the lake dwellings were also spread over the mainland.

Before giving the substance of the two reports on Ebersberg by Mr. G. von Escher von Berg, which shall here be combined

in one, it may be well to make one or two remarks on the pottery which has been found at this place.

A consideration of the earthenware vessels here discovered, made of such various forms, and in some cases not without taste, and always answering the required purpose, both in form and material, leads to the impression that at Ebersberg, as well as in the lake dwellings, the manufacture of earthenware vessels formed a particular occupation, and that it was exclusively carried on by individual settlers. The mixture and working of the clay for the particular sorts of manufacture, the form of the vessels made by the hand alone, their ornamentation, and the mode in which they were burnt, show, in the opinion of those conversant with the art, such a degree of ability and proficiency, that only those individuals who devoted themselves exclusively to this work could produce such wares as we now see before us.

As the vessels made of clay took the first place in the household economy of the settlers for keeping both their liquid and solid food, and also were their only cooking utensils, it may be easily imagined that the faculty of invention very early introduced a great variety in the form and ornamentation of these products.

The following is the substance of Mr. G. von Escher's two reports condensed into one :—

The mountain ridge of the Irchel terminates at its north-western extremity in the bed of the Rhine, or rather, it may be said to project into this river. For it seems as if at some far gone time the Rhine had found a way through the mountains which previously dammed up its waters so that they spread over the adjoining flat country. It now flows through a narrow channel between the terrace cliffs of Schaffhausen, four or five hundred feet high, in a southerly direction, till the Töss runs into it, when its course takes a sudden turn nearly at right angles. On either side of what was formerly a lake, rise two hills commanding the flat land far around—the 'Haarbuck' (perhaps originally Hardbuck) on the right, and the 'Ebersberg' on the left bank of the river. The latter hill stands alone like an outwork of the high Irchel, from which it is separated by a valley. It is not unlike a four-sided pyramid the top of which has been taken off by the hands of man, and has a flat surface on the summit of about an acre and a half. On the west side it slopes precipitously to the river, which runs below at a depth of 550 feet; and on the southern side is the

only gentle slope, which is prolonged to a hollow or gorge running to the Rhine at right angles, so that here also the hill is isolated. In addition to this, there is here a trench running in an oblique direction, the lower part of which has disappeared under cultivation, and it terminates above before it quite reaches the plateau of the hill. There is no doubt that this trench was made by the settlers to secure the only accessible part of the hill. As the place offered great advantages for safety, it must, necessarily, in all ages, have attracted the attention of the inhabitants of the country. As a point of observation also, Ebersberg was of considerable importance, for nothing could escape the view of a watchman set upon the top, either on or near the river, from the falls of the Rhine down to the mouth of the Töss. In this respect there is no height like Ebersberg for a view over such a wide extent of country. It is well known that a stronghold was situated on the point of Ebersberg till the year 1336, when it was destroyed by the people of Zürich in a feud with the nobles of the district. Before that race of barons, it may reasonably be assumed that the Romans, who founded several stations along the Irchel, had used Ebersberg for military purposes, and had at least placed a specula on this spot. But till these excavations it was never supposed that the first inhabitants of the country ever had a settlement here.

The original discovery was made in the following manner. In May 1851, I was accompanying a friend on the road leading near one or two ancient sites, through the pass between the Rhine and the Irchel, to the spot where the castle of Radeck formerly stood on a spur of the mountain. I had already reached the southern slope of Ebersberg, immediately above the gorge mentioned above, when I saw some labourers at work with carts. As there is a gravel-pit on this side of Ebersberg, I thought that the people were busy repairing the road, and fetching material for this purpose. But when, on my return, I met one of the carts, I was not a little surprised to remark that it contained rich black mould, mixed with a large quantity of charcoal and bits of burnt clay, and that they were using it for agricultural purposes. They told me that in the place where the carts were loaded broken pottery was found in abundance, and besides this, bronze pins, teeth of animals, and horns of red sandstone with engraved lines, had been discovered there. Of course I made haste to the place, and secured the above mentioned specimens. Fragments of brownish unglazed pottery (evidently of Gallic make) had turned up in great quantities,

and I also found the problematical stone horns with the characteristic zigzag Gallic ornaments. By the kindness of my neighbours, I succeeded in obtaining, the same day, several other implements of bone, stone, and bronze.

In consequence of this, an excavation was commenced by me, jointly with my friend Mr. Edward Merian, of Teuffen, and carried on for a week with four men. Unfortunately, a cross-road, very much used, ran immediately over the place which promised the best results; in addition to which, it was a serious and costly work to remove a bed of alluvial earth five feet thick, which we had to do before reaching the layer containing the antiquities, now called the relic-bed. This great depth of alluvial earth over the area once occupied by the settlement, which is marked by the burnt wood, the clay burnt red, the black earth very much trodden down, and by all the objects of human industry found here, was at first a mystery to us, and we were tempted to imagine some slip of the ground; but, on later examination, this is impossible: the covering of earth was not made in this way, for there is a total absence of gravel in it, but it is simply the power of nature alone which has here been at work: this bed has evidently been formed by a very slow alluvium coming from the land above. Who can say what changes in the conformation of the surface of the earth may have been brought about by a power constantly acting for three thousand years? *

A layer of charcoal ashes was met with almost everywhere

* There is something to my mind very inexplicable in the depth of soil under which ancient remains are occasionally buried, especially in those localities where earth is not likely to have been washed down from higher grounds. In a field which forms the south-west portion of the ancient city of *Isca Silurum*, I have frequently excavated for the sake of archæology, and in one instance, when the summer was dry, the grass showed where walls were probably to be found, indicating the ancient Roman houses, forming the corner of the inhabited portion, an open space or street being between them and the city walls. It was, however, very singular that these indications, though correct, were not verified till the ground had been excavated to a depth of five or six feet; and before the actual base of the wall and the floor of the street were reached, a tall labourer was entirely hidden from view. The first foot or two may be accounted for by rubbish, when the place was destroyed, but as no soil is likely here to have been brought down by floods, we are almost obliged to attribute the remaining four or five feet to the annual additions of vegetable mould. The excavation above referred to, is not the only fact which indicates a great accumulation of soil; a handsome tessellated pavement, lately discovered in the churchyard, was four or five feet below the present surface, and one can hardly imagine that it was so originally. The trees also, in many of the gardens at Caerleon, flourish very well till their roots go down to the Roman rubbish, when they immediately begin to wither. May not the mass of earth, spoken of by Mr. G. von Escher, have arisen from a gradual accumulation of vegetable soil?—[Tr.]

over the remains of the old settlement, and besides this, in the first excavation above referred to, many of the antiquities found seem to have been damaged by fire. It seems, therefore, reasonable to conclude, that at least a part of this settlement was burnt to the ground, but whether this catastrophe was caused by chance or by the hand of an enemy I do not venture to decide. In the notice of the later excavation some reasons will be given which show that the latter view of the case is improbable.

The second excavation in 1862 was much more extensive than that in 1851. The work began on June 13, and, with some interruptions, it was continued till August 9. In sixty-four days an area was excavated of from 4,500 to 5,000 square feet.

The 'relic-bed' was a foot and a half thick, and, as before mentioned, about five or six feet deep, and, with its numerous fragments of pottery, its stone and bronze implements, and its animal remains, rested in general upon a floor consisting of clay and pebbles carefully beaten to a level. In two places there was a pavement of pebble stones. Two hearths were found on this floor, near to one another, in the shape of parallelograms, about five or six feet long and three feet broad, made of rough pebble stones and clay mixed with a very large proportion of sand. The loose 'relic-bed,' as already mentioned, consists, in great part, of a mixture of rich black earth, small pieces of charcoal and bits of clay burnt red, and is very distinct in colour from the overlying bed of earth, five or six feet thick, in which no remains have ever been found. Close to the original floor there was, throughout, a bed of ashes varying in thickness. On and in this bed we found a very large quantity of animal remains.

We will now proceed to describe the antiquities found at Ebersberg, including those discovered in both excavations :—

1. Pottery. As far as numbers are concerned, the fragments of different descriptions of earthenware vessels take the first place. Very many were found when Ebersberg was first examined, and in the later excavation more than 1,500 pieces were found, of which, however, only about 250 are worth preserving. Very few vessels were met with entire, but still, from the fragments, the shape of many can be very distinctly made out. They agree in form, to a considerable extent, with the earthenware vessels found in the tumuli, as may be seen by comparing them with those drawn in the third volume of the Transactions of the Zürich Association, and which illustrate the paper entitled 'General Remarks on the Pagan Graves in Switzerland;' there are, however, several forms, not given in these illustrations, which are found at Ebers-

berg as well as several new kinds of ornamentation. I have therefore given (Plate LXXXIX. fig. 10) the 'restored' forms taken from the fragments of several vessels not drawn in the above-named treatise; and in Plate XC. figs. to 1 to 15, will be found several of the kinds of ornament not given there. These forms and ornaments are frequently met with amongst the fragments.

The variety of the patterns on the ornamented pottery is really perfectly astonishing, if we consider that it is brought about almost exclusively by combinations of straight lines, and that curved lines are very seldom used. Most of the vessels are ornamented on the outside. Inside ornamentation is only found on flat or open vessels like plates or dishes.

Many of them have been coloured either with ruddle or with graphite, which appears to have been well rubbed in and smoothed. None were found painted with two colours, like some of the Gallic pottery. In certain cases the line ornaments, which were often not conspicuous to the eye, were set off by the furrows or lines being filled with white chalk.

The material out of which the pottery was made varies considerably: sometimes the clay was unwashed and full of extraneous substances; sometimes it was intentionally mixed with grains of quartz and felspar; and sometimes the vessels were made of carefully washed clay and were of really good workmanship. Of many hundred vessels, the fragments of which lie before me, I am assured by those who are skilful in the potter's art, that none of them indicate the use of the potter's wheel; all were made by the hand alone, finished with the scraper, and burned, not in closed furnaces, but in open fires, consequently they are badly and not uniformly burned—at all events they do not ring when struck.

The fragments of the earthenware vessels show all possible variety, both in size and form, from flat to close vessels, and from little cups to urns widely bulging, in which corn and other materials might be stored. On many of them there appear to have been neatly-formed handles, so that they might either be carried or suspended. Several forms have been already referred to (Plate LXXXIX. fig. 10), 'restored' from fragments which clearly indicate the shape; but there are others which have fortunately been preserved entire, such as those drawn Plate LXXXIX. figs. 8 and 9, and Plate XCI. fig. 4, respecting which the drawings will speak for themselves. The large vessel drawn Plate XCI. fig. 1, is remarkable both for its form and ornamentation;

but this is not all, it is one of several specimens which have been found at Ebersberg where there is the same problematical arrangement, which has been already referred to elsewhere in this volume, namely a row of holes either vertically or diagonally one above the other, chiefly near the border or edge. The vessels with this peculiarity vary very much in form; sometimes they are shaped like a plate, sometimes like a bowl or cup, sometimes they are hemispherical below and cylindrical above, in which case the row of perforations is vertical. The holes are always made in the line ornaments which run round parallel with each other; they are not always of the same size; in the smaller vessels they are narrow and in the larger ones they are broader. It is difficult to imagine what could be the use of these holes; if they had been intended to have drawn off a portion of the liquid contained in them the lowest hole would have been sufficient; and the same remark will apply to the idea that they were intended to drain the water from moist food which was required to be dry. Vessels with similar holes have been found in the ruins of the lake dwellings, and the use of them has been generally explained by supposing that they were intended to separate the whey from the curdled milk. I venture, however, to propose another explanation: may not these vessels have been used to separate the honey from the honeycomb? It is evident that at certain temperatures the honey would flow through these small openings, leaving the wax behind. This hypothesis deserves the more consideration as a similar plan is said to prevail at the present day both in the Emmenthal and also in the Bernese Jura. These perforated vessels were not met with very commonly in the first excavation; amongst the fragments of perhaps 500 vessels only five borders were found with this peculiarity. In the late excavation they were found in much greater abundance.

Amongst the more perfect earthen vessels found here, one is especially worthy of notice; it is a small pipkin made by the hand alone, but very neatly fashioned out of purified clay, and it is remarkable for having no base but terminating below in a cone. The clay rings, well known in the lake dwellings of the western lakes, were also found here, and the two sets of specimens throw light on each other. The pipkin was evidently set upon the clay ring, and both together were then placed on a hearth of glowing embers and charcoal. This arrangement, in fact, was by no means a bad one, because by this kind of stand the sides of the pipkin were gradually and not suddenly heated, and thus the fluid contents were not burnt at the bottom.

A sketch of both the pipkin and the ring is given Plate XCI. fig. 3.

To this class of objects probably belong the little cylinders wider at the top and the bottom, the actual use of which is unknown, but which occur of exactly the same form in the lake of Bienne, and are drawn Plate XXXVII. figs. 6 and 7.

The implements in the form of a pyramid, perforated at the top (Plate XCI. fig. 11), were used doubtless for stretching the threads in the loom.

The objects drawn Plate LXXXIX. figs. 2 and 3, and XCI. figs. 12, 20, and 21, are evidently spindle-whorls.

Under this head may also be noted a number of fragments of the layer of clay which covered the wattlework walls of the huts. These pieces were tolerably smooth on one side, but on the other showed the deep impressions of the basket-work. (Plate XC. fig. 16.) On one side also they were hardened and coloured by the action of fire, but on the other side they were soft—a proof that they had not been burnt till the conflagration of the huts.* Fragments of clay flooring were also found some inches thick, beaten down above like a thrashing-floor, but uneven below, and filled with small pebbles, stones, and other kinds of things which happened to be on the ground when the flooring was laid down.

Moon Images.—Though one of the objects which bear this name is of pottery and the others of stone, yet, as they are of especial interest, they deserve a section to themselves. Amongst all the objects brought to light in the first excavation at Ebersberg, probably that drawn Plate XCI. fig. 17 is the most remarkable. One horn is wanting in the original specimen, which consists of the base and one horn only, but the second has been added in the figure, as from specimens subsequently found there can be no doubt as to the form of these objects. The first view of the original specimen gave the idea of a horn, but on examination it was clearly seen to be only part of a figure representing the crescent moon. This specimen was the first which had come under the notice of antiquaries, and, till its discovery, images of this form appeared to be totally unknown, both in Switzerland and other countries. As these peculiar

* In the narrative of the expedition to the Zambesi, it is stated by Mr. Livingstone, p. 534, that the huts have no ruins except when they are burned, and then a thin layer of the red clay with which they were plastered, and the impressions of the reeds which formed the walls remain, with the colour and consistence of soft bricks; but these soon moulder away.—[Tr.]

images have been very fully treated of in the chapter specially devoted to them, it will be only necessary here to describe the specimens found at Ebersberg, and to say that they are considered as objects of Gallic worship.

The specimen (Plate XCI. fig. 17) is of reddish sandstone, and is ornamented on one side with line ornaments.

The smaller half crescent (Plate LXXXIX. fig. 7), also of reddish sandstone, is covered on the front with line ornaments; it only differs from the last in size and mode of ornamentation.

Fragments have also been found made of the same material, and exceeding the first in size; as they had no ornaments upon them, they probably belonged to the back of the image.

These moon figures, however, were not all made of stone. Plate XCI. fig. 5 is one of them in terra-cotta found in the later excavation. It is 6 inches high, and 10½ inches in width.

In some respects it resembles the stone images described above, and in others it bears the greatest similarity to those found in the lakes of Bienne and Neuchâtel, which are also made of clay.

3. *Stone Implements.*—Three small stone celts were found here: two of them are of a kind of stone like serpentine, the other of brownish flint (Plate LXXXIX. figs. 5 and 6). The celt drawn Plate XCI. fig. 24 is of a stone like nephrite. Some cutting implements were met with made of flint, from the chalk formation of the Jura; this flint is found amongst the rolled stones of the gravel covering the banks of the Rhine, especially in the basin below the falls of Schaffhausen. Some roundish stones of granite, flattened at both ends, and commonly called corn-crushers (Plate XCI. fig. 22), and also a number of stones of various sizes, made apparently by human hands into the shape of balls or eggs occurred here.

A large piece of reddish sandstone, with several continuous lines and elevations is not without interest. At first sight it looked very like a moulding or cornice, though this idea did not at all agree with the grade of civilisation shown in other objects found here. But on examination the furrows and rounded grooves are not of the same depth nor breadth, neither do they run parallel with each other, so that in this supposed moulding I recognised a whetstone or grindstone for the manufacture of celts and other objects such as we have described. Similar slabs have since then been found in most of

the lake dwellings, and I am quite convinced that this is the true explanation.

The most singular object in stone, however, is that drawn Plate LXXXIX. fig. 1. It is a piece of porphyry, shaped like a pulley; it is as regularly rounded as if it had been made by a lathe, and leads to several enquiries. First, we may ask how it was possible, with such imperfect tools as we see before us, for so very hard a material to be so admirably manufactured? Secondly, to what use could it be applied? With respect to the workmanship, it is evident, when closely examined, that the stone has been brought into its present form by grinding. But what labour and trouble this must have caused! If the celts of flint and hard serpentine, &c., give us an idea of the dexterity and patience of the primitive workman, the labour and skill required by the specimen before us is perfectly astonishing. I have not yet succeeded in determining its use. My antiquarian friends differ exceedingly in opinion respecting it. I have not found anything like it described in the works on Gallic or German antiquities. Since this specimen was found the investigations in the lake dwellings have brought to light similar objects, though not perhaps of equal workmanship, and antiquaries now call them 'slingstones;' but this term must be considered as conventional, for it can hardly be imagined (at any rate with respect to our specimen) that so much labour would be bestowed on objects which very probably might be used only once.

4. *Glass.*—The only object found of this material was a bead of a whitish blue colour, just like those which have been found in graves and Roman settlements (Plate XCI. fig. 2).

5. *Horn and Bone.*—Horns of the roebuck were occasionally met with, more or less worked, and antlers which had been used for tools; there were also a number of fossil sharks' teeth, which had been got out of the 'molasse' and perhaps had been used for piercing tools. But the most convincing proof of the small advances which had been made in civilisation by the settlers at Ebersberg is given by the lance point of bone found in the rubbish, and drawn Plate LXXXIX. fig. 11 and Plate XCI. fig. 6. When we look at this implement, we are almost compelled to believe that the settlement at Ebersberg was founded in the very earliest ages, when Switzerland was first inhabited. For, in the first century of our era, the Gauls, according to the accounts of Greek and Roman authors, were so far advanced as to understand thoroughly the employment of

metals for every purpose of war, husbandry, and household economy; they had also abundance of iron (which is entirely wanting at Ebersberg) and they had given up both making and using implements of bone.

6. *Bronze Implements.*—The objects which fall under this head are the following. Fragments of two knives (Plate LXXXIX. fig. 12 and XCI. fig. 10); a few dozen hair and clothes pins of different forms and sizes, some of which are drawn Plate LXXXIX. figs. 13, 14, 18, and 19, and Plate XCI. figs. 7, 8, 9, 14, 15 and 16; several wires neatly worked round in a spiral form (Plate XCI. figs 13 and 23); several little chisels (Plate LXXXIX. figs. 15, 16 and 17); a finger ring (Plate XCI. fig. 18) and an earring (Fig. 19), and a number of bands and rings (Plate LXXXIX. fig. 4) ornamented in various ways; and, lastly, an arrow-head (Plate XCI. fig. 25).

No implement of iron of any kind in either of the excavations was found here, and nothing which had the appearance even of oxidation; in fact, no metal was found but bronze, and of this the quantity was so small that the weight of the whole hardly amounted to ounces. No particular skill in the workmanship or elegance of form is to be observed in any of the bronze implements.

7. *Animal Remains.*—According to the determination of Professor Rütimeyer, the bones found at Ebersberg belong to the following species. 1. A large species of the cow. 2. The pig. 3. The sheep. 4. The goat. 5. The stag. 6. The roe. 7. The dog or wolf. 8. The chamois (?).

In conclusion, I may remark, as a singular fact, that the pottery found here was scattered about in such a way that the single fragments belonging to one and the same vessel were seldom or never found together, a fact which would lead one to suppose that these things might have been intentionally broken to pieces, and thrown away, if we had not observed that the bones of animals were scattered in a similar manner. There was, however, clearly no particular place fixed on for a rubbish heap, and broken vessels lay about the house, just as is the case amongst all people who are but little civilised.

The presence of bronze implements may possibly have some connection with a hostile attack and a violent destruction of this settlement, for what was there to hinder the emigrants, if leaving peaceably, from taking these small things with them? But even the very minuteness of these objects, only discovered by us after very careful search, would render it almost impossible

for the inhabitants to find them after they had been lost in the dirt surrounding the huts. It is rather a matter of wonder that so few things of the kind should have been found in the excavation of an area of 4,500 square feet. Besides this, no very large quantity of ashes or charred wood occurred here, and no human remains, and consequently no indications of a sudden destruction of the settlement by the hand of an enemy.*

G. VON ESCHER VON BERG.

Eigenthal.

II. BURG (ANCIENT CASTLE) NEAR VILTERS.

Vilters is in the Canton of St. Gall, not far from Ragatz and the celebrated baths of Pfeffers. The rocky eminence called Burg Vilters lies about half an hour's walk up the mountain which overlooks the plain: it is on a mass of rock 30 or 40 feet high, and very difficult of access. It commands a wide view of the whole valley of the Rhine, and from it may be traced the course of the Roman military road leading from Coire to Sargans. It is very evident that a Roman watchtower (specula) was placed here, from the numerous Roman antiquities which have been discovered. They consist of remains of walls, tiles, and a number of bronze and iron implements belonging to that period, such as rings, needles, buckles, styles, chains, knives, lance-points, and coins down to Constantine the Great. But the *first occupation* of the place occurred at a much earlier period, and the settlement then made was contemporary with the lake dwellings, as may be proved from the numerous antiquities found here. Excavations were made at the top of the rock in the year 1862, when flint saws, corn-crushers, stone spindle-whorls, stone celts, bone chisels, a half-moon ornament, and bronze arrow-heads were met with, all of them objects precisely similar to those found at Ebersberg. The portion of a floor made of stamped clay seems also to have been a remnant of the older settlement.

* In Sir John Lubbock's very interesting work, lately published, it is mentioned, p. 128, that the settlements of Ebersberg was built on piles. Is not this a slip of the pen? for no mention is made of piles in the two reports by Mr. Escher von Berg, the substance of which is given above, and which I am informed contain the only information as to this settlement. It may possibly have been built on piles, but it appears to me there is no evidence to prove this, and as the ground was well beaten down, and coated with clay and gravel to make a flooring, this fact seems to militate against the idea of the houses having stood upon piles.—[TR.]

III. UETLIBERG.

In the time of the Romans there was a building on Uetliberg near Zürich, the highest point of Mount Albis, as is proved by the Roman tiles, pottery, tools, and coins found there. There was also a castle here in the Middle Ages which was destroyed at the end of the thirteenth century. But this place must have been inhabited long before this, quite in the early ages, in the period of the lake dwellings; for at a depth of four or five feet fragments of pottery exactly like those of the lake dwellings were found, together with a very large number of the bones of various animals which had been intentionally broken, as well as implements of various kinds.

A few of the antiquities found here are drawn on Plate XCII. Fig. 1 is a fragment of red pottery with very coarse ornamentation, apparently made by the nail. Fig. 2 is another fragment with rather a peculiar ornamentation: two lines or furrows roughly scored with smaller lines, and interrupted with bosses placed at irregular distances, seem to have gone round the vessel; from the coarseness and irregularity of the work it almost has the appearance of having been done by the worn-out point of a piece of bulrush or some other reed; the colour of this fragment is black. Fig. 3 is a bronze chisel; the section is oval. Fig. 4, a stone celt of the usual form. Fig. 5 is a bone-piercer. Fig. 6 may perhaps be considered as a bronze pin. Fig. 7 shows four little peculiar bronze ornaments; two of them are perforated at each end, and the other two are not perforated at all; they are not of twisted wire but of solid bronze filed so as to have that appearance. Fig. 8 is a small bronze wheel; it may possibly be of a later age than the other things drawn on this plate. Fig. 9 is evidently the handle of one of the bronze moon images found at several settlements in the western lakes. Fig. 10 is a small ornament apparently of solid bronze, wrapped round with bronze wire.

IV. WINDISCH.

At this place (the Roman Vindonissa) where Mr. Laupper has made extensive excavations and has uncovered ground to the extent of many acres, numerous remains have been found both of earlier and of Roman date. The most interesting discovery, however, which he made was that of a clay flooring

several feet below the surface, and of which he opened a part for me to see when I went there on hearing of what he had found; he assured me that he had repeatedly met with similar flooring. At the limits of this flooring there was rather a long heap of the pieces of clay coating of the huts with impressions of the wattlework, just like that at Ebersberg. Mr. Laupper had satisfied himself that this heap lay in a circular form and not in straight lines, the included space being covered over with charcoal and ashes. On the outside of this heap of clay coatings there was found a great quantity of Celtic pottery, both whole and broken; bones of pigs, horses, and, as he believes, of men; also bronze clasps, rusted iron implements, &c. Amongst other things which I saw myself were some portions of the clay hut-coating, coloured white and red; as at Ebersberg one side of these clay fragments was hard and had changed colour by heat, and the other side was soft.

A few of the earliest antiquities found here are drawn on the lower half of Plate XCII. Fig. 11 is a flint knife. Fig. 12 a flint scraper. Fig. 13 a large and strong stone celt. The sections of these three implements are shown at the sides of the figures. Figs. 14 and 15 are the regular well-known corn-crushers; and Fig. 16 is a bear's tooth with the fang perforated, probably intended for an amulet or ornament.

As the present work refers more especially to the lake dwellings and not to antiquities in general, probably these few instances will be sufficient to enable the reader to compare the settlements on the mainland with those in the lakes, and also to convince him that both descriptions were the work of one and the same people.

SIMILAR SETTLEMENTS BEYOND THE SWISS DISTRICT.

BAVARIA.

In June 1864, Professor Desor and his assistant discovered in the lake of Starnberg the remains of a lake dwelling of the stone age: it is situated on the left shore, near the little island called Roseninsel, where the king has a summer palace. When this locality was carefully examined, many objects of bronze were found, together with bones, horns, and a quantity of pottery of the usual description. But the specimens obtained here were not of any very great interest.

MECKLENBURG.

In the year 1863 the remains of a lake dwelling were discovered at Gägelow, near Wismar, and subsequently Dr. Lisch ascertained the existence of a regular lake dwelling in the peat moor of the town of Wismar, which goes by the name of Lattmoor.

This low ground, which is partly dug for peat and partly used as a meadow, undoubtedly in early times formed a regular large freshwater lake: the surface was then considerably lower, and some portions of land appeared above the water as islands, and were covered with wood. The lake where the piles are found is about ten feet deep, and it is at present quite filled with black mould, the remains of leaves, and decayed waterplants. In this mould the piles are to be seen ten feet long and about two feet apart: they have been driven two feet into the ground. The remains of five huts were also to be noticed, some of them rectangular, and some of a round form. Upon the black mould which fills the ancient lake basin, there is at present a bed of alluvial earth one foot thick, but the heads of the piles do not reach up to it. Above this bed there is a stratum of peat five feet thick.

The antiquities, which were found in considerable numbers

amongst the piles, are in general very similar to those of the Swiss lake dwellings. We may, however, remark that amongst the stone implements flint takes the place occupied in Switzerland by serpentine, diorite, &c., and that the pottery exhibits a remarkably peculiar character.

This lake dwelling evidently belongs to the later stone age.

From the account of Dr. F. v. Hagenow, it appears that he has also discovered a lake dwelling at Greifswald, in Western Pomerania.

(See the 'Jahrbücher des Vereins von Mecklenburg,' by Dr. Lisch, 1865.)*

* It is perhaps right to say that in some of the German periodicals a doubt has been lately expressed as to this Wismar settlement having been an actual pile dwelling. I cannot see why; our information is taken from Dr. Lisch's published report, and this is clear and decisive.—[Tr.]

NOTICES OF THE IRISH CRANNOGES.

ABRIDGED FROM THE ACCOUNT GIVEN OF THEM BY SIR W. R. WILDE, AND OTHER ANTIQUARIES.

These stockaded islands, or crannoges as they are called in the Irish annals, have been so fully described, chiefly by Sir W. R. Wilde, in the Proceedings of the Royal Irish Academy, and in his Descriptive Catalogue of this Society's Museum, that it may seem needless to do more than merely refer to his detailed descriptions. Still a work on lake dwellings would be incomplete without some notice of them, and the following account has therefore, by his permission, been extracted chiefly from his reports: some few facts have been added from the observations of other antiquaries.

It is uncertain whether the name of crannoge was derived from the timber employed in enlarging, securing, and fortifying the island, or from the wooden houses erected on it, or whether it was also applied to log-houses on the land. But, although alluded to so early as the middle of the ninth century, it is remarkable that no examination of a single crannoge occurred till the end of the year 1839.

These islands are chiefly found where several small lakes are clustered together. They were not strictly speaking artificial islands, but cluans, small islets or shallows of clay or marl, in these lakes, which were probably dry in summer time, but submerged in winter; these were enlarged and fortified by piles of oaken timber and in some cases by stone work. A few were approached by moles or causeways, but, generally speaking, they were completely insulated, and only accessible by boats, and it is a singular fact that in almost every instance an ancient canoe was discovered in connection with the crannoge. Being thus insulated, they afforded secure places of retreat from the attacks of enemies, or were the fastnesses of predatory chiefs or robbers, to which might be conveyed the booty of a marauding excursion, or the product of a cattle raid.

It may naturally be concluded from the amount of oaken timber invariably discovered in these stockades that the neighbouring country was well wooded; it is also manifest from the quantity, age, and variety of the antiquities discovered in these crannoges that they had been long occupied. We likewise learn from their recent submerged condition how much water had accumulated on the face of the country since their construction, probably owing to the great decrease of forest timber, and the increased growth of bog. From the additions made to the height of the stockades and also from the traces of fire discovered at different elevations in the sections made of these islands it may be inferred that the rise of the waters commenced during the period of their occupation.

The first examined and described was that at Lagore near Dunshaughlin, county of Meath: full particulars of it have been given by Sir W. R. Wilde, in the Proceedings of the Royal Irish Academy for April 1840, and also in his Catalogue; and the reader who wishes to know all the details is consequently referred to these volumes. It may be as well, however, here to give a few particulars, abridged from Sir W. R. Wilde's works, for the sake of comparison with the Swiss lake dwellings.

'This crannoge differed from all others since discovered, not being then either submerged or surrounded with water; it consisted of a circular mound, about 520 feet in circumference, slightly raised above the surrounding boggy or marshy ground, which forms a basin of about a mile and a half circuit, and is bounded by elevated tillage and pasture lands. The lake in which the crannoge was situated has been drained within the memory of man, and the discovery of the crannoge took place in consequence of the large quantity of bones which were found when clearing out a water-way partially surrounding it. One hundred and fifty cartloads of bones were taken away for manuring purposes.

'The circumference of the circle was formed by upright posts of black oak, measuring from 6 to 8 feet in height; these were mortised into beams of a similar material, laid flat upon the marl and sand beneath the bog, and nearly 16 feet below the present surface. The upright posts were held together by connecting cross-beams, and (said to be) fastened by large iron nails: parts of a second upper tier of posts were likewise found resting on the lower ones. The space thus enclosed was divided into separate compartments, by septa or divisions that intersected each other in different

directions: these were also formed of oaken beams in a state of good preservation, joined together with greater accuracy than the former, and in some cases having their sides grooved or rabbeted to admit large panels, driven down between them. The interiors of the chambers so formed were filled with bones and black moory earth, and the heap of bones was raised up in some places within a foot of the surface.' The animal remains consisted of those of several varieties of oxen, also swine, deer, goats, sheep, dogs, foxes, horses, and asses. With these there was a vast collection of antiquities—warlike, culinary, personal and ornamental—of stone, bone, wood, bronze, and iron. They consist of swords, knives, spears, javelins, and dagger blades, sharpening stones, querns, beads, pins, brooches, combs, horse-trappings, shears, chains, axes, pots, and bowls. (See the Proceedings of the Academy, vol. i. p. 425, and also the Archæological Journal, vol. iv. p. 101.) Some human remains were also found there.

Soon afterwards numerous other crannoges were discovered, which it would be tedious to enumerate. It will be sufficient to mention that when Sir W. R. Wilde published his catalogue about forty-six were known, viz. twenty in Leitrim, twelve in Roscommon, two in Cavan, six in Monaghan, and one in each of the counties of Limerick, Meath, Westmeath, Down, King's County and Tyrone.

It may be well here to give the general results of the examination of these crannoges from the reports of the engineers of the 'Board of Works.'

They are surrounded by stockades driven in a circle from 60 to 80 feet in diameter; but in some cases the enclosure is larger and oval in shape. The stakes of these stockades are generally of oak, mostly young trees from 4 to 9 inches in diameter, usually placed in a single row, but sometimes in double and in a few instances in treble rows. The portions of these stakes remaining in the ground, generally bear the marks of the hatchet, by which they were felled. Several feet of these piles must have originally projected above the water, and were probably interlaced with horizontal branches so as to form a kind of screen or breastwork.

The surface within the staked enclosure is sometimes covered over with a layer of round logs cut into lengths of from 4 to 6 feet. In one instance, at Cloneygonnell, parish of Kilmore, county Cavan, the wood within the enclosure consisted of planks, laid in a radiating form, the interstices being filled with short

blocks, small branches, and bark (Proc. of Royal Irish Acad. viii. p. 274). As a general rule the mass of wood was covered with more or less stones, clay, and gravel. In a crannoge, described by Mr. G. Henry Kinahan in Lough Rea (P. of R. I. Acad. viii. p. 413), a very singular flooring of basket-work was found three feet lower than the present level of the lake; it rested on the mass of timber, but only extended over a part of the area excavated.* It was also remarkable that a vertical wall of wattle or basket-work was discovered, which from the drawing strongly resembles that of Ebersberg, described in the present volume, and drawn Plate XC. fig. 16. An arrow-head of chert from the lime-stone, a bone piercer, a pair of iron shears, a brass pin, a crosier made of brass, a battle-axe, a hammered iron ladle for smelting, and the mould for a coin made of plaster of Paris, were found here. The last specimen was unfortunately lost. Quantities of bones were met with of oxen, sheep, goats, deer, pigs, and dogs or wolves, and also, very singularly, the head of a Megaceros Hibernicus. Mr. Kinahan mentions a suggestion by Professor Jukes that this specimen does not prove that the animal lived when the crannoge was inhabited, as it might have been brought there merely as a curiosity.

In some crannoges the platform is confined to a portion of the island. Pieces of oak framing, with mortises and cheeks cut in them, have sometimes been found within the enclosure.

In almost every case a collection of flat stones was discovered near the centre, apparently serving as a hearth; in some instances two or three such hearths were found in different parts of the crannoge. Generally one or more pairs of querns were met with, and in very many cases large quantities of bones of black cattle, deer, and swine.

Of course it is impossible in a mere cursory notice of these crannoges to give many particulars; the full details must be looked for in Sir W. R. Wilde's works and in the Proceedings of the Royal Irish Academy, especially in vols. vi., vii., and viii. Professor Harkness has described a crannoge in Drumkeery Lough (Archæologia, vol. xxxix. p. 482); and Mr. M. Digby Wyatt also has brought the subject before the Institute of British Architects.

But though the reader is necessarily referred to the above original works for full information, it may still be advisable to

* May not this so-called basket-flooring have been a portion of the wattle walls which had fallen down?—[Tr.]

give here a few illustrations which will afford a general notion of these singular structures. Plate XCIII. fig. 1 is the section of the crannoge in Ardakillin Lough, near Stokestown, county of Roscommon; it is constructed both of stones and oak piling; the top line shows the former highest water level; the second that of the ordinary winter flood; and the third the general summer level. 'The upper layer of the crannoge was formed of loose stones surrounded by an enclosing wall supported in part by piling: the lower portion shows as far as it is possible on so small a scale the original clay, peat, and stones of the island, on which were found, in various places, strata of ashes, bones, and logs of timber. The oak piling of different descriptions is shown in section; that driven obliquely being sheet piling which was continuous all round the island.' (See W. R. Wilde's 'Catalogue of Irish Antiquities,' p. 226.)

Drumaleague Lough in the vicinity of Lough Scur, county of Leitrim, was about a mile in length, and when lowered 13 feet, disclosed two crannoges, also a canoe of a single piece of oak, 18 feet long, 22 inches broad, square at stem and stern, and remarkable for having apertures for row-locks cut into the sides.

Plate XCIII. fig. 2 is the plan of one of the crannoges in this Lough, and affords a good idea of the general arrangement of these timber structures. The outer paling of stakes includes a circle 60 feet in diameter, in some places double or treble; there are clusters of stakes in other portions of the island, some of which appear to have been placed with regard to a particular arrangement, A. The central oblong portion consists of a platform of round logs, cut in lengths of from 4 to 6 feet, chiefly of alder timber. B, a collection of stones with marks of fire on them. C, a heap of stiff clay. D, the root of a large tree nearly buried in the peat, the surface of the wood bevelled off with a hatchet, so as to form a sort of table, under which a considerable quantity of bones was found, apparently those of deer and swine.

Plate XCIII. fig. 3 shows the section of the second crannoge in Drumaleague Lough; it was 72 feet in diameter within the circle of oak stakes, only two of which of course are represented in the Plate. Between these may be seen, in the section, B, horizontal pieces of alder timber, laid upon the natural surface of the island, each log being from 3 to 8 inches in diameter, all water-soaked and rotten. This stratum was 3 feet 6 inches deep. A, a heap of stones with marks of fire upon them; other

hearths were found in different parts of the island. C, the lower stratum of black, rotted sticks and branches of all sorts lying in all directions. This stratum was examined for 4 feet in depth and appeared to continue deeper. DD, two heaps of stones found in the lower stratum. E, a large quantity of the bones of deer, swine, &c., found together about 4 feet below the surface. The circle of this island, which was tolerably regular, was formed by a single row of oak stakes.

To the above accounts we may append a brief notice of a crannoge in the parish of Clogherney, Barony of East Omagh, county of Tyrone. It was investigated by the Rev. Rob. V. Dixon, D.D., Rector of Clogherney, to whom we are indebted for the following particulars. 'It presents some peculiarities, and no account of it has as yet been published. It was found in a bog on the borders of Roscavey and Clogherney Sliebh; it lay in a hollow, running nearly east and west between two sloping hills. The fall of this hollow is towards the east, where it spreads out and sinks into a large basin or glen, closed by rising ground of considerable height to the north and east, and by a gravel ridge or "Esker" on the south, and opening on the west into the hollow in which the crannoge stood. A considerable mountain stream enters this basin from the east, and after flowing round a conical gravel hill (connected with the Esker) which stands in the middle of it, escapes through a deep natural cut or gap in the Esker, which, as before mentioned, closes the basin on the south. If this cut were closed the basin would be filled up by the stream which now flows through it and the level of the water would probably rise up sufficiently high to fill the hollow in which the crannoge stood, and this hollow would then form a shallow arm of the lake. The crannoge was found on cutting away the bog which had grown over it. About 8 or 10 feet below the surface the workmen came on the top of a row of oak planks, forming a circle about 70 feet in diameter. The planks were roughly split from the log, and were from 8 to 14 inches wide, and from 3 to 5 inches thick. When discovered they were about 4 feet long, but they had, to all appearance, been originally longer, as their tops were all jagged and decayed, as if the upper part had rotted away. The lower ends were rudely pointed and sunk some 10 or 12 inches in the clay. Each plank had a rude square hole cut in it, evidently formed by a blunt tool, most probably a metal one, wider on both the sides of the plank and narrower in the middle. Several rough logs of

soft wood, alder, birch, &c., from 2 to 4 inches in diameter were laid horizontally against the lower part of the planks on the inside of the enclosure. In the centre of this enclosure was found a floor formed of oak planks with some 18 inches or 2 feet of turf below it, and between this floor and the outer fence were several flagstones, evidently used as hearths from the quantity of pieces of charred wood found about and beneath them. The planks forming the enclosure were placed edge to edge and in close contact. The entrance was to the south and was marked by two square posts.

'There are some points connected with this crannoge which present peculiar difficulties. Unless, as described above, the cut in the Esker was closed, by which the basin or glen is drained, this structure never could have stood in a lake, and if it had not this security there appears no reason why a structure of its peculiar character should have been erected there. Again, it does not appear how the heavy planks forming the enclosure were originally supported and secured; for they were not more than 10 or 12 inches deep in the clay; nor is it easy to conjecture what was the use of the mortise holes, cut with such labour in them, and which were just on a level with the surface of the clay or below it. Again, it is difficult to understand what preserved the existing four feet of these planks perfectly sound while the upper part rotted away. If they were originally set up in bog of that depth, indeed, their preservation would be accounted for while the portion above rotted, and bog to the extent of 8 or 10 feet was subsequently formed over them; but there are several objections to this view.'

A large number of the antiquities found in the Irish crannoges have been figured and described under their various heads by Sir W. R. Wilde in his Catalogue and in the Proceedings of the Royal Irish Academy.

Also in vol. iii. page 44, and in vol. vi. page 101, of the Archæological Journal: these will be referred to by those who wish to study the crannoges carefully. But in order to give some idea of the nature of the objects found in them a selection has been made from the above-named sources and given in the lower part of Plate XCIII.

Figs. 4, 5, and 6, are bone cloak pins from the crannoge of Ballinderry in the county of Westmeath; the two first are each made of two pieces; the shank is made with a shoulder on which the flat portion is fixed which forms the head. Fig. 4

is 4½ inches long, and the circular head is 1 inch in diameter. Fig. 5 is 3⅛ inches long. The pin drawn Fig. 6 is square in the shank and has a looped head, through which is passed a ring also of bone. It is 5½ inches long, is highly decorated all over, and is so sharp both in the carvings and at the angles as to lead to the belief that it had never been in use.

Fig. 7 shows the head of a bronze pin, the size of the original, found at Ardakillin crannoge.

Fig. 8 is the drawing of a rare type of bronze pin; it has three rings passed through apertures in the elongated head; it is 3 inches long and was found in the Dunshaughlin crannoge.

Fig. 9 represents a triangular piece of coarse white sandstone with hollows on both sides to form moulds for castings; upon that here presented, we find the mould for a simple celt 3 inches long; and another for one 4 inches long with a cross stop and a ring for attachment to the shaft. This stone is 7¼ inches long. It was found in the Lough Scur crannoge in the county of Leitrim.

Figs. 10, 11, 12, 13, and 14 were all found in the crannoge of Lagore, near Dunshaughlin.* Fig. 10 is an iron spearhead 10 inches in length. Fig. 11, a double edged sword of iron formed with a central ridge and 15¼ inches long. Fig. 12 is also a double edged iron sword, 22¼ inches long, including the strig or tang which passed through the hilt; the blade is 18½ inches long, 1⅓ inches wide, and is formed with a wide shallow groove or channel along its entire length.

Fig. 13. A blade of iron curved towards the point, in some degree resembling certain oriental weapons; the curved portion alone has a cutting edge, and this is the case on both sides. Fig. 14 an iron knife.

It now only remains to give very briefly a few extracts from Irish annals, with their dates,* in order to show that history is not silent respecting them.

A.D. 848. Cinaedh, son of Conaing, lord of Cianachta-Breagh in Meath, went with a strong force of foreigners, plundered

* Sir W. R. Wilde (P. of R. I. A. vii. p. 148) mentions amongst other things found at Derry hollow, a coin of Charles II., probably, as he says, fixing the date of the latest occupation of this crannoge. From the pottery found in the crannoges generally Sir. W. Wilde thinks that they were probably occupied from the ninth to the sixteenth century. 'Between this period,' he says, 'and the prehistoric times of the sepulchral urns, we have not the slightest vestige of pottery.' It must be confessed, however, from what is stated in this account, that pottery seems to have been very much neglected in excavating crannoges.

the island of Loch Gabhor, and afterwards burned it so that it was level with the ground. ('Annals of the Four Masters.') Thus we see that Lagore crannoge was occupied a thousand years ago.

A.D. 1246. Turlough * * * made his escape from the crannoge of Lough Leisi in autumn, having drowned his keepers. ('Annals of the Four Masters.')

A.D. 1436. The crannoge of Lough Laoghaire, near Clogher, in Tyrone, was taken by the sons of Brian O'Neil. ('Annals of the Four Masters.')

A.D. 1512. Philip Maguire made an incursion into Tullyhaw, county of Cavan, and from thence they proceeded to the crannoge of Magauran which they took. ('Annals of the Four Masters.')

A.D. 1603. Hugh Boy O'Donnell, having been wounded, was sent to Crannog-na-n-Duini, in Ross Guilt, to be healed. ('Annals of the Four Masters.')

It is needless to multiply quotations, and this short notice of the Irish crannoges may be closed with the words used by Mr. Shirley:* 'The crannoge was the universal system of defence in the north of Ireland.'

* Shirley's 'Account of the Territory or Dominion of Farney.'

NOTICE OF THE SCOTCH CRANNOGS.

BY JOHN STUART, ESQ., SECRETARY OF THE SOCIETY OF ANTIQUARIES OF SCOTLAND.

The discovery of crannogs* in Ireland, and of somewhat similar lacustrine remains in Switzerland, concurred to draw attention to the subject in Scotland, when for the first time the scattered notices of piled islands, some of which had been recorded for many years, took shape and revealed the fact that the system of stockaded islands had at one time been common in many parts of the country.

Mr. Joseph Robertson was the first who brought the subject of Scotch crannogs under the notice of archæologists in a paper which he read in December 1857 to the Society of Antiquaries of Scotland, entitled 'Notices of the Isle of Banchory, the Isle of Loch Canmor, and other Scottish examples of the artificial or stockaded islands called Crannoges in Ireland, and "Keltische Pfahlbauten" in Switzerland.'

A discovery of a group of artificial islands in the Loch of Dowalton in Wigtonshire occurred in the autumn of 1863, and was described by Lord Lovaine, now Earl Percy, in a paper read to the British Association at its meeting at Newcastle in September of that year.

At this time the drainage of the Loch of Dowalton was not so far advanced as to allow a complete inspection of this group of islands. About a year afterwards, however, when I visited the place, the whole bed of the loch was exposed, and the islands were approachable.

I was so much interested in the subject that I was induced to prepare for the Society of Antiquaries of Scotland a paper giving a detailed account of the construction of the Dowalton

* In these notices, which Mr. Stuart has kindly prepared expressly for this translation of Dr. Keller's lake dwellings, and for which I beg to return to him my best thanks, he spells the word 'crannog.' In other parts of this volume the word is spelled 'crannoge,' which on the whole I prefer, as being probably the more usual mode As, however, these notices have been kindly furnished by Mr. Stuart, his spelling of the word has of course been followed.—J.E.L.

Islands, and of the remains found in them; and as Mr. Robertson's other engagements had prevented him from amplifying his paper, and adding to it accounts of other crannogs which had come to light since it was read, I took the opportunity of incorporating in my descriptions all the facts which I could glean, so as to afford a basis for comparing the Scotch examples with those in other countries. This paper was read to the Society in the month of March last, and since that time Mr. Robertson handed to me his paper and notes, of which I have made use in preparing my own paper for the press.

The lacustrine remains of Scotland admit of a certain classification. There are first crannogs proper, by which I mean islands in lakes, artificially formed on wood or surrounded with wooden piles, of which, including the group in Dowalton, there are known about thirty-five.

Then there are sites in marshes where vestiges of piling, or other indications of former crannogs have been found, and of these there are ten.

Besides these, we have in many lakes natural islands which have been fortified principally by barriers of stones surrounding them and by causeways leading from them to the shore, and these are very numerous.

Of the first class, or the crannog proper, the ordinary construction was by logs of wood in the bed of the lake supporting a structure of earth or stones, or of a mixture of both, the mass being surrounded by piles of young oak trees in the bed of the lake, the inner row of which kept the island in shape, and the external rows acted as defences and breakwaters.

The crannogs at Dowalton were differently constructed. The surface of the islands was of stones resting on a mass of compressed brushwood, below which were large branches and stems of small trees, mostly hazel and birch, mingled with stones, apparently for compressing the mass. Below this were layers of brushwood, fern, and heather, intermixed with stones and soil, the whole resting on a stratum of fern which lay on the bed of the loch.

Some of the islands were surrounded with beams of oak mortised into each other and laid in a sloping position to the outer edge and were probably intended as breakwaters, and occasionally planks of oak with grooves in them were noticed. Several canoes formed of oak and from 21 to 25 feet in length were found in the loch. One of them was discovered under the foundations of a crannog.

On the larger islands great quantities of the teeth and bones of animals were found, principally of the ox, pig, and goat.

Various articles were picked up on the islands and their neighbourhood. Amongst these was a bronze dish with a handle. It measures 8½ inches in diameter at the mouth and 6 at the bottom, its depth being 5½ inches. The handle is 7 inches long and is stamped with the letters CIPIPOLIPI. The vessel corresponds in style and workmanship with bronze patellæ found on Roman sites in various parts of England.*

Several other dishes of bronze were found, some of them much mended. Of ornaments there appeared beads of glass, one of amber, a small brooch of bronze, and bits of armlets of enamelled glass. There were several iron hammers, whetstones, a small earthen crucible, querns, and pieces of slag.

All the articles were collected by Sir William Maxwell, of Monreith, who has presented them to the national museum of the Antiquaries of Scotland.

On a rising ground near the loch is a rath, in which respect it agrees with numerous Irish examples, where raths are found on the shores of lochs containing crannogs.

A curious structure of the nature of a crannog has recently been noticed in a moss on the estate of Jardine Hall, belonging to Sir William Jardine, but as yet has only been partially examined. It was discovered while digging for peat in a bank of from 12 to 14 feet in height, and consisted of a large number of oak trees lying parallel and close to each other, forming a sort of platform, with 6 or 7 feet of peat below and as many above it.

The portion of the platform as yet uncovered is from 20 to 30 feet wide, while the ends of the trees can be followed in the face of the bank for at least 150 feet. The platform is covered with twigs of birch, and above this a layer of common bracken.

This layer of birch, twigs, and bracken is about 10 inches thick, and appears uniformly to cover the platform except at one point, where flattish whinstones are laid on as a sort of pavement over the trees, the space so covered being an irregular circle of 6 or 7 feet in diameter. On this spot, fragments of burned wood were very numerous, and beside it were found

* A Roman station was placed at Withorn, the Candida Casa of Bede, about four or five miles from Dowalton.

seven large 'bowls' or cups cut out of oak, and a rude oak mallet with a branch as a handle. The 'bowls' were from 10 inches to 1 foot in outside diameter. The logs and twigs were all cut as if by a sharp instrument, and two of the logs had mortise holes cut in them from 2 to 3 inches square.

I hope to examine this curious structure with care when it is divested of moss, which will be soon. My information at present has been derived from Sir William Jardine and Dr. Arthur Mitchell.*

JOHN STUART.

August, 1865.

* I am tempted here to insert an extract from a letter lately sent to me by the Rev. C. W. King, and my friend will pardon me for copying it exactly as it was received; any alteration of his epistolary style would weaken the force of his acute remarks 'Did it never strike you, when Cæsar talks of the Morini taking refuge in their marshes, and Dio Cassius of Severus pursuing the Caledonii into theirs, in which he lost 50,000 of his own troops, that such facts presuppose the existence of pile fortresses, or at least of *crannoges* in these morasses? for these Celts required a "pied à terre" literally, to enable them to hold out any time in such situations; they could not squat for weeks like a flock of wild ducks upon the surface of the morasses.'—[TR.]

APPENDIX.

REMARKS ON THE BOOK ENTITLED 'HABITATIONS LACUSTRES DES TEMPS ANCIENS ET MODERNES,' PAR FREDERIC TROYON.*

I cannot refrain, in conclusion, from making some remarks on the above-mentioned volume, and I am quite satisfied that they will be considered both correct and necessary by every Swiss antiquary who has studied the phenomena of the lake dwellings, not merely in the account given by the journals but from actual observation.

In the work referred to it is brought forward as a notable discovery, not only that all our lake dwellings are to be divided into those of the stone, the bronze, and the iron ages, as well as what are called those of the transition periods from stone to bronze, and from bronze to iron; but that the introduction of bronze into the lake dwellings coincided with the immigration of a new people totally different from the primitive inhabitants, and, again, that the diffusion of iron implements coincided also with a change of the population.

According to this classification, the settlements of Eastern Switzerland belong to the stone age, viz. those in the lakes of Constance, Pfäffikon and Moosseedorf. And as bronze is found, though in small quantities, in the settlements of the lakes of Zürich and Sempach, as also at Concise in the lake of Neuchâtel, these lake dwellings are to be placed in the transition period from stone to bronze. The greater part of the settlements of the lakes of Bienne and Neuchâtel together with those of the lake of Geneva are said to belong to the bronze age, while some in the lakes of Bienne and Neuchâtel fall under the transition

* At first it appeared to me that these remarks might have been omitted in an English translation of Dr. Keller's works on the lake dwellings, but a little consideration convinced me that the original discoverer of the 'Pfahlbauten' would not have justice done to him if they were suppressed. M. Troyon's book having been written in French has obtained probably a wider circulation in England than Dr. Keller's notices, which were written in German, and though almost entirely based upon them, yet in many respects gives such a different version that it seems but fair that Dr. Keller should point out the discrepancies, as otherwise he might be implicated in the conclusions of M. Troyon, from many of which, as it will be seen, he entirely dissents. These notices, however, are put in the appendix, so that they may easily be passed over by anyone interested in the discussion.—[Tr.]

age from bronze to iron, or rather under what is called the first iron period—that is, the Helvetic.*

The condition of the population at the different periods is represented in this volume in the following manner:—

'The people of the *first period* were entirely ignorant of the use of metals. Hunting, fishing, cow-keeping, and some small amount of agriculture, afforded the means of subsistence. Flax and hemp were cultivated for other requisite purposes; barter was carried on with foreign lands. Industrial skill was in a very primitive state, for the small stone hatchets as yet show no artificial perforation, and the productions of the potter's art exhibit neither the elegant forms nor the variety of ornamentation of the later ages. This first period is said to have come to a sudden end by the irruption of a people provided with bronze implements. The lake dwellings were burnt by these new comers,† and the primitive inhabitants were slaughtered or driven back into remote places. This catastrophe affects chiefly the settlements of East Switzerland which entirely disappeared, and also a number of those on the shores of the western lakes; some few settlements, however—namely, those of the so-called transition period—are said not to have been destroyed by the new people till after the inhabitants had begun to make use of bronze implements.

'*Second period.*—A new era as to the lake dwellings begins, according to this work, in Western Switzerland with the sudden appearance of bronze, for Europe is said not to have known a copper age. It is, however, not the new people who have now got the land in their possession, but the old population which was not entirely destroyed and gradually became united with the rulers of the country; they again appeared on the lake dwellings and continued their former manner of life. The diffusion of bronze, at first occurring only in imperfect productions, caused a rapid development of civilisation; the conditions of life became favourable; the dwellings were better constructed; industry made great advances; the working of leather, the art of weaving, and that of making garments, were much benefited by implements of metal. The products of the potter's art receive new and elegant forms and fresh modes of ornamentation; attempts were also made in casting. New stations were erected, and those destroyed were restored from the lake of Bienne to that of Geneva. The images or figures, relating to moon worship, are said not to belong to the bronze but to the iron period. Burning the dead is also stated to have been introduced by the new people. Population increased in the lake dwellings,‡ but it is

* The Allobroges who lived on the banks of the lake are classed amongst the inhabitants of lake dwellings (of the first iron period), though Suidas, ii. 64, does not say a syllable about their habitations.

† The clay balls, which in the 'Habitations lacustres' are considered as incendiary missiles to set fire to the huts, are nothing else but weights to fasten to the threads in the loom.

‡ From the curve of some few pieces of the clay covering of the huts, not more than a foot across, which fell into the water and hot when the dwellings were burnt, and were thus fortunately preserved, and which from this or some other cause have been bent, the author of the 'Habitations lacustres' calculates the circumference of the

asserted to be of a different race from that which at the same time inhabited the mainland of Eastern Switzerland in the bronze period. This second period is made to come to an end in a similar way by the destruction of all the lake dwellings.

"'*Third period.*—Again a new people appears on the scene, fighting with iron weapons; as they are said to come from a country without lakes, they do not occupy the lake dwellings. The two elements of the ancient population are subjugated, decimated, driven into the mountains, and the lake dwellings are burnt down. However, again some few families of the primitive population escape this second tempest. About a dozen lake dwellings spring up on the shores of the lakes of Bienne and Neuchâtel, the inhabitants of which adopt the manner of life of the second conquering race; instead of the regular lake dwellings, miserable huts are erected in which the fishermen's families eke out a wretched existence. The remains of pottery show that these abodes were still inhabited in Roman times. The population of the third or iron period are said likewise to have burnt their dead, but to have deposited their ashes in urns under sepulchral tumuli.

'The following are said to have been the names of the people of these different periods. The population of the first period are a primitive people, perhaps belonging to a Finnish or Iberian race which came out of Asia several thousand years before our era, and following the course of the Rhone or the Rhine wandered into the valleys of the Alps. The people of the second period are the Celts who likewise came out of Asia. The weapons used by them in attacking and destroying the lake dwellings were of bronze, for in their own country they had attained to great skill in working this metal. The people of the third period are the Helvetii, who left their abodes in South-Western Germany. They are more advanced in civilisation; they slaughter the earlier inhabitants with swords of iron, and destroy the lake dwellings which had been established afresh in Western Switzerland.'

Such is the account given in this volume of the condition of the population during the different periods, and such is represented as the fate of inhabitants of the lake dwellings.

I am about to bring forward some objections to the division of the lake dwellings into those of the stone, the bronze, and the iron periods, so far, at least, as they are said to coincide with the appearance of different nations, and to show that a sudden leap from one class of civilisation to another cannot be proved by investigating the remains of the lake dwellings, but that the metals became gradually spread amongst the settlements like any other article of trade. Before doing this, however, I must first be allowed to make some corrective remarks, respecting the account given of their geographical division, and also as to the picture drawn of the manner of life amongst the inhabitants.*

huts, makes them fitted to hold four persons, estimates the number of huts on an entire lake settlement, and, lastly, determines the amount of the population contained in it!

* Many traits in this picture are correct, and are based on facts published by me in my own reports, which have been entirely swallowed up (in toto verschluckt) by the 'Habitations lacustres.'

In the first place, with respect to the geographical distribution of the lake dwellings of the stone and bronze ages, and the opinion that the modern limits between those parts of Switzerland distinguished by speaking French and German could possibly mark in like manner the boundary between the settlements of the stone and bronze ages, this view is gainsaid by the situation of the lake dwelling of Peschiera, especially belonging to the bronze age, which lies far more eastward than the stone settlements of Eastern Switzerland; the settlement of Moosseedorf also, which is essentially of the stone age, is surrounded by places which were furnished with bronze either in a smaller or larger quantity; and, again, the bronze implements lately found in the settlements on the lake of Constance, and on the south side of the Roseninsel in the Starenberger See near Munich, show the futility of such a division. It is also equally impossible now to draw a definite line of demarcation between the lake dwellings with or without iron, as Inkwyl and the lakes of Sempach and Mauensee do not belong to West Switzerland, and yet have afforded implements of iron.

With respect to the conditions of life of the first period, the results of investigations in the lakes of Pfäffikon, Niederwyl, and Constance, show that cereals in general formed the chief article of food;* moreover, that hemp was not grown at all, but that flax, on the contrary, was cultivated to a great extent, and was worked with so much skill that the variety of woven linen cloth made with such imperfect mechanical aids actually astonishes us. We may conclude with all certainty that the clothing of the colonists of the stone age consisted chiefly of thinner or thicker linen cloth. With respect to the handicraft ability of the settlers, so far as implements of stone are concerned, not the slightest difference can be seen between the products of this first period and the following one, or the so-called transition period; for precisely the same forms are found in the earlier age and in that when bronze begins to appear; and not only so, but perforated and even ornamented stone celts are found more commonly in the stone period, and more especially at St. Aubin, a station of the pure stone age. The pottery of the first age indicates considerable dexterity in working clay, and consists of vessels and cups of various forms with the commencement of the very same ornaments which cover the productions of the later period.

The assertion that all the lake dwellings of the stone age were burnt down by the irruption of a foreign people is not correct, for at Niederwyl and several lake dwellings of the Unter-See no traces of fire have been observed. The fact that in all the lake dwellings of the stone age, nay, more, that in the whole of these settlements yet examined not half a dozen human skeletons† have been found, contradicts

* The large number of vessels with remains of burnt corn, and more especially the small quantity of animal bones, show the prevailing use of vegetable food in the lake dwellings of the stone age, for instance, in those of the Unter See.

† Since this was written a few more human remains have come to light in the lake dwellings, but still the whole number is surprisingly small.—[Tr.]

the supposition of a battle having taken place between the aborigines and the supposed conquerors, and of the destruction of the former by the latter. The reason why so many stone and bone implements, not only broken and useless but also in good condition, are found on the sites of the lake dwellings may be explained simply by the fact that the colonists, when, either from the burning of their houses or from some other cause, they were obliged to settle on the mainland and erect new abodes, would hardly have given themselves the trouble of collecting out of the mud all the celts and other implements, which the archæologists are now searching for with such avidity. The fact that nearly every ancient lake dwelling has either a larger or smaller village corresponding with it on the shore, and still existing, seems to indicate these fresh settlements of the population both of the stone and the bronze ages.

It is not easy to make out what is the actual definition in this volume of the term 'transition period.' According to the theory brought forward, certain lake dwellings, such as Meilen and Concise, must have procured bronze implements by friendly intercourse with the new comers, and yet, notwithstanding this barter, were destroyed by the intruders.

The hypothesis that it was the most ancient population, and not the conquerors with bronze arms who rebuilt the burnt lake dwellings, must have been brought forward, because it is hardly to be supposed that the new people, who were much further advanced and totally different in culture and manner of life, would have settled down in the very places they had burnt and erected lake dwellings anew.

Second period.—The assertion that 'Europe has never known an age of copper' may be tolerably correct (see page 219) with respect to western Europe, but by no means so for the eastern portion. Plate LXVIII. gives sketches of a number of copper implements which have been found in the district of the Danube.

By the general use of better bronze implements a notable change doubtless took place in handicraft ability which would have a decided effect on the general condition of the settlers; but we should like to know on what is grounded the assertion that 'the preparation of leather, the art of weaving, and the making of garments took a considerable start,' for at the time when the volume in question was drawn up not a single thread had been found in the bronze settlements of Western Switzerland, nor any trace of leather.

If it be asserted that the population during the bronze age in Western Switzerland was different from that which at the same time settled on the mainland in Eastern Switzerland, let the remains of civilisation in the settlement of Ebersberg given in Plates LXXXIX., XC., and XCI. be examined and compared with those of Nidau Steinberg, and the comparison will afford a convincing proof of the complete identity of the industrial products of both settlements.

The statement respecting the period to which the moon images belong is quite erroneous, as these objects of civilisation do not occur in the iron age but are quite peculiar to the bronze period. Again, the

closest investigation has not as yet afforded the smallest information as to how the lake settlers buried their dead. If it be affirmed that the people of the bronze age introduced the custom of burning their dead, this is directly contradicted by the fact that in all the graves of our district known to us of this period, and in which bronze implements are met with, the remains of the body show that it was not burnt.

Third period.—The work in question then goes on to state that the lake dwellings were burnt down a second time; and in this case by a people armed with iron weapons, pouring down from Southern Germany. According to the very accurate observations of Colonel Schwab probably about a quarter of the lake dwellings in the lakes of Bienne and Neuchâtel show traces of fire, a proof that a sudden and general destruction of all these settlements is out of the question. There is certainly something striking in the presence of so many bronze implements in the ruins of the lake dwellings, more especially as no small number of them remained occupied in the Helvetian and Gallo-Roman times. The existence of implements of various different kinds in the area of their abodes could not have remained unknown to the inhabitants, and they would certainly have dredged them up if the value of these objects had been worth more than the time and trouble of obtaining them. Who can say whether this may not have actually happened, and whether the specimens now remaining to us may not be simply the gleanings? If we reckon up all the bronze implements yet found—the swords, the javelins, the knives, the celts, the rings, &c.—and divide these objects amongst all the lake dwellings yet examined, the number of these specimens will appear quite inconsiderable for the quantity which must have existed if all the lake dwellings had been suddenly destroyed, and for the most part abandoned.* And it must be borne in mind that at the present moment the search for antiquities is carried on with great energy with all kinds of apparatus, such as 'nippers' and mud-machines, and at a great expenditure of time and labour.

With respect to the name and ethnographical determination of the people who lived partly in lake dwellings and partly on the mainland, and who at first made use of stone implements and consequently are considered as aborigines, anyone who has a fancy may object to their having any relationship with the Celtic element, and attribute to them a Finnish or Iberian origin, or connect them with the race of men discovered by Boucher de Perthes—thus far is certain, that they do not differ in the smallest degree, either in their abilities, their manner of life, or their industrial attainments, from the people who were provided with metals; but that in the whole phenomena of lake dwellings from their very beginning to the end of their existence a gradual, quiet, peaceful development may be observed. The traces of conflagra-

* A complete inventory of the bronze implements in the collection of Colonel Schwab now lies before me, comprising more than three-fourths of all the bronze articles found in West Switzerland and also nearly a perfect catalogue of those in other collections.

tion, and the presence of so many implements amongst the remains of the lake dwellings by no means contradicts this position, for was there ever a village of straw-roofed huts which during some centuries of its existence has not been burnt down either by accidental calamity or in the course of intestine quarrels?

From what has been said, it appears certain that there is no foundation for the hypothesis that the inhabitants of the lake dwellings are to be separated into distinct races, because in the earliest times they had no metal implements and in later times they possessed them. Nothing can be more true than the remarks of Dr. Lindenschmit, respecting such suppositions as to the change of nationalities based simply on a difference in implements. 'The simple exchange of material,' he says, 'the transition from the use of stone to that of metal is in itself not a sufficient ground for inferring a change of population. It is not so important as the change from the spear to firearms; and if at every advance of this kind an entire change of population were to be supposed, the history of civilisation would only have to relate the migrations of nations.'*

With respect to the immigration of the Celts into Europe, this event belongs to the primitive history of the peopling of our part of the world, and is shrouded in impenetrable darkness. No tradition speaks of the Celts pressing forward towards the countries in the possession of which we subsequently find them, though the Druids, on the other hand, taught that the Gauls were aborigines. At the very first appearance of historical† narrative they appear in the far west of the Iberian peninsula, and afterwards as the first amongst the great northern nations which pressed forward eastward from their homes in the west. Now, if it is a fruitless labour in archæology to determine the time of their arrival in Europe, it must be considered as entirely an idle pastime to speak of the degree of civilisation then possessed by this people, who in later times spread over the whole of central Europe, and still more so to affirm that, at the time of their immigration, they had a perfect knowledge of bronze, understood the mixture of copper and tin so as to produce a harder material, and were thoroughly acquainted with the art of casting.

No less venturesome is the assertion that the Helvetii conquered the land with iron weapons and burnt down the lake dwellings, because they had no lakes in their country, and did not understand this manner of life; and all this at a time when bronze in great quantities was spread over the country and this peculiar kind of settlement had reached its highest state of development. They are said to have immigrated when hardly any iron implements were to be found in the lake dwellings. But the immigration of the Helvetii is an event belonging to tradition, and it is perfectly impossible to fix its date. It is evident from the history of the Celtic tribes living east of the Rhine that, when pressed by the Germans, they left their own country, and

* Lindenschmit, 'Die vaterländischen Alterthümer,' p. 159.

† Herodotus, iii. 33, iv. 49. Zeuss, 'Die Deutschen,' p. 160.

that the Germans laid it waste and afterwards left the Helvetii no rest even in their new abodes.* But there is not the slightest information given whether the Helvetii left their homes from necessity or were influenced by the desire of conquest, nor in what relations they stood with the Gallic race on this side the Rhine.† But granting that they passed the Rhine as conquerors, how is it possible to suppose that they were perfectly equipped with iron implements when their neighbours on this side the Rhine were without them, and that at a period when the most active exchange was going on, as is clearly shown by the spread of exactly similar bronze implements over central Europe? Can it be imagined that the race living between the Rhine and the Black Forest had surpassed in civilisation the people who lived on this side of the Rhine, whose country lay open to the influence of the civilised lands on the shores of the Mediterranean, by the paths of the Alps and the valley of the Rhone, as may be proved by the bronze implements brought from those parts? It is a pity that when the volume of 'Habitations lacustres' was compiled, the large number of lake dwellings containing Roman implements were not known; had they been so we should doubtless have had a third conquest of the country—that of the Alemanni—a fresh conflagration of the lake dwellings, and a decimation of the population as a final close to the drama.

We cannot here enter on an examination of the picture given of the graves said to have been erected by the lake settlers on the shores of the lake of Geneva, and of the Helvetian manner of living and industrial powers, in which everything is detailed, belonging to the Gallic and Gallo-Roman periods; we can, however, give our assurance that in this chapter, as in many others, right and wrong, relevant and irrelevant are mixed up together in a confused mass.

The phenomenon of the lake dwellings, so important in the history of civilisation,‡ the time of their first establishment, their original design, their development, and their final extinction, in spite of many accumulated facts, is in many respects clouded in doubt. Whether we may consider the first settlers as a branch of the Celtic race who spread over Europe in the earliest times, and were already acquainted with agriculture, can neither be affirmed nor denied with certainty. The extremely simple tools of the oldest lake dwellings exhibit a striking contrast to the productions of their industry and agricultural activity. It is certain from the very beginning of this peculiar mode of living to the latest period of its existence, while outward circumstances remained the same, a quiet advance to a better development of the conditions of life may be observed, in which there was neither retrogression nor any sudden advance by the intervention of foreign elements. The general diffusion of metals in a country which had none is explained

* Cæsar, i. 1.

† See pp. 262 and 263.

‡ M. Jayet has lately shown in the 'Bulletin de la Société Vaudoise des Sciences Naturelles, 1862," that the calculations of the age of the lake dwelling at the foot of Chamblon near Les Uttins, not far from Yverdon, is incorrect.

simply by the barter which existed throughout Europe in the very earliest ages. The question why the inhabitants of a lake dwelling of the stone age abandoned their settlement, while those of another, not many hours' or many minutes' walk distant, remained quietly living on their platforms, is of no greater importance than the enquiry why, during the middle ages, so many localities have disappeared, the names and situations of which are known to us. The presence of objects of industry on the area of the lake dwellings has nothing in it very surprising, if we consider what misfortunes villages of straw-covered huts were exposed to, in which not only the houses themselves, but even the platforms on which they stood, were formed of very combustible materials. It is possible, if we are to take Cæsar's account literally, that when the Helvetii, whose arrival in the country is neither mentioned in history nor shown by archæology, withdrew, the lake dwellings then existing were, as a whole, burnt down; but there can also be no doubt that some remained standing, or were rebuilt after the return of the population. Their continuing down to the Roman time is only astonishing to any one who imagines that at this time the whole population had gone over to the Roman manner of life, while the proof lies before him that the lower class adhered to their own manners and customs till the entrance of the German races.

As before mentioned, notwithstanding all the investigations which have hitherto been undertaken, there is very much in this field of enquiry yet to be explained; nay, even the rapid accumulation of material increases the difficulty of a satisfactory conclusion; but it is very much to be regretted, if the ideas we form of these discoveries (which we are still far from understanding as a whole) should, by venturesome hypotheses, by artificial combinations, and by arbitrary interpretation of facts, be clothed with a poetic mantle, which the sober and conscientious observer may find it difficult to throw off, as the greater proportion of antiquaries, especially the foreign ones, are not thoroughly acquainted with the actual facts of these phenomena, and of their relation to the other antiquities of Switzerland.

LATEST DISCOVERIES IN THE SWISS LAKE DWELLINGS.

After the preceding pages had been put in type, further information has been obtained, and some very interesting specimens have come to light, and we cannot resist giving another plate and a few brief additional notices. Archæological discoveries in Switzerland are now almost of daily occurrence.

St. Aubin.—This settlement was mentioned in the geographical list, but since that was written, the zealous and intelligent antiquary, Dr. Clément, has carefully examined the locality and obtained from it a most splendid collection of very fine implements of stone, bone, and horn. Celts, knives, and daggers are found in great abundance of all kinds of stone and of every possible form. The tools and handles of horn, and the bone implements, are very numerous and in capital preservation. No objects of wood were met with, and but little pottery.

It is a very extensive settlement of the pure stone age, and has a 'steinberg' or 'ténevière' from 200 to 300 feet in diameter, the south-west side of which is rather muddy. Piles are seen all over it, but more especially on the north side. The average depth of the water is from 8 to 9 feet, but the relic-bed can only be reached by digging 3½ feet under the present bed of the lake.

A number of flint arrow-heads found here are of great interest, as they may throw some light on the duration of the settlement. It appears that after having been brought into form, they had been damaged by use, and then a second time worked up and sharpened. The parts of the flint which belong to the original manufacture had become white by age, while those portions which indicate the second operation are 'honey yellow,' or the natural colour of the stone. This difference in the appearance of the surface clearly indicates that an interval of many centuries must have elapsed between the first manufacture and the second operation of sharpening. One of these arrow-heads is drawn Plate XCVI. fig. 11; the light portion is the surface of original manufacture; the darker parts are the chipped edges arising from the resharpening; the very dark shade represents the remains of the asphalt which still adheres to it, showing how it was attached to the shaft.

Amongst the ornaments from this station are perforated fossil terebratulæ, and also a few belemnites round which a groove has been cut for the attachment of a string (Fig. 7). There are also perforated vertebræ of fishes, both fossil and recent.

ESTAVAYER.—A knife has lately been found here by Dr. Clément of St. Aubin, and is now in his splendid collection. It is drawn Fig. 3, and is very remarkable on many accounts. The metal portion of the handle is of bronze, as the figure will show, but the blade is of iron ornamented just like those of the bronze knives. From this specimen we may draw several conclusions:—1st. Iron was gradually introduced as a rare and costly material. 2nd. The first iron implements were exact imitations of those which had previously been made of bronze. 3rd. The workman in making these new implements and utensils tenaciously adhered to the old patterns; but 4thly, by degrees he found out the forms to which the new material was most adapted.

MARIN.—Colonel Schwab has obtained from this station several more iron swords, some of which had 'maker's marks' similar to those previously found; others were new, such as Figs. 4, 5, and 6; the latter is somewhat indistinct. With respect to the mode of manufacture of these swords, to which attention has been called by M. de Reffye (page 247), there can be no doubt that the central portion was of different metal from that of the two sides. Colonel Schwab has had one of the swords drawn out of its sheath, and I have shown it to several individuals skilled in working iron, and they assure me that the middle portion is of iron and the two sides are of steel. The sides have oxidized very much less than the central part, which is pitted with rust, leaving a few places projecting more than the rest, as shown in the drawing Fig. 10, while the two steel sides, each rather more than ⅛ of an inch wide, are comparatively smooth. The whole breadth of the blade is about an inch

and a quarter. The bone of a stork, made use of as a case for a bronze needle, (Figs. 8 and 9), was also found here.

LES ROSEAUX near MORGES.—A singular bronze ring has been found here by M. Forel, drawn Fig. 1. It is hollow, and there are circular holes, one at each side at A and B. All round the outside are the ornaments called Celtic. The five ribs or projections are very singular. M. Forel thinks that the ring was intended to be held in the hand (see the reduced Fig. 2), and that the spaces between the ribs were for the fingers, but if so it must have been used by a very small hand, for the drawing of Fig. 1 is half the full size.*

WANGEN.—Mr. Löhle has found several perforated portions of the smaller branches of stag's horn, which evidently were intended for necklace beads. One of them is drawn Fig. 12.

* A friend suggests that this may have been the central ornament of a necklace the string passing through the holes at A and B.—[TR.]

EXPLANATION OF THE PLATES.

FRONTISPIECE.

Ideal Restoration of a Swiss lake dwelling, p. ix. of the Preface.

N.B.—Every particular in this sketch is based on actual fact.

PL. I. MEILEN.

Fig. 1. Ground plan, p. 11.—2. Section, p. 14.—3. Arrangement of the piles, p. 16.

PL. II. MEILEN.

Figs. 1, 5. Hammers of stag's horn, p. 27.—2. Stone celt set in stag's horn, p. 19.—3. Hafting of stag's horn with a chisel of nephrite at each end, p. 20.—4. Stone celts in hafting of stag's horn, p. 20.—6. Stone hammer partially perforated, p. 22.—7, 8. Corn-crushers, p. 25.—9. Hammer of stone like serpentine, p. 22.—10. Hammer of spotted serpentine, p. 23.—11. Cylindrical corn-crusher, p. 25.—12, 13. Stone celts, p. 18.

PL. III. MEILEN.

Fig. 1. Flint saw in handle of yew-wood, p. 24.—2, 3. Flint tongues or points, p. 24.—4. Stone awl, p. 25.—5. Whetstone, p. 25.—6. Bear's tooth perforated, p. 27.—7, 9, 24, 27. Earthenware vessels, p. 29.—8. Amber bead, p. 28.—10, 11. Implements of boars' teeth, p. 27.—12. Bronze armilla, p. 28.—13. Spindle-whorl of earthenware, p. 30.—14. Oak club, p. 28.—15, 16, 19, 20, 21. Bone awls or piercers, p. 26.—17, 18. Bone needle and pin, p. 26.—22. Flint arrow-head, p. 24.—23. Grindstone for making celts, p. 24.—25. Bone chisel, p. 26.—26. Bronze celt, p. 28.

PL. IV. MOOSSEEDORF.

Fig. 1. Map of the district, p. 32. A, village of Münchenbuchsee; B, Hofwyl; C, Moosseedorf; D, Steinbrück; E, Eastern lake dwelling; F, Western lake dwelling; GG, Canal; HI, Commencement of the peat moor; KK, Shell marl (Weisser Grund; blancfond); LL, Peat; M, Schönsicht; N, 'Molasse' rock; O, Ancient outlet of the lakes; P, Great lake of Moosseedorf; Q, Smaller lake.—2. Ground plan of part of the Eastern settlement, p. 33.—3. Section of the Eastern settlement, p. 33.

PL. V. MOOSSEEDORF.

(All the figures half size except 14, 20, 22.)

Fig. 1. Celt hafting of fir-wood, p. 34.—2. Celt hafting of stag's horn, p. 34.—3. Harpoon of stag's horn, p. 34.—4. Bone lance-point, p. 34.—5. Flint saw

in handle of fir-wood, p. 34.—6, 7. Needles made of boars' tusks, p. 34.—8. Awl made of the bone of the roe, p. 34.—9. Bone knife, p. 34.—10. Bone chisel, p. 34.—11, 12. Wedge of fir-wood, p. 34.—13. Bone awl, p. 34.—14. Fishhook made of a boar's tusk, p. 34.—15. Boar's tooth ground to an edge and perforated, p. 34.—16. Needle (?) of boar's tusk, p. 34.—17, 19. Flint flakes for scaling fish (?) p. 34.—18. Arrow-head of rock crystal, p. 34.—20. Sharp celt of nephrite, p. 34.—21. Comb of yew-wood, p. 34.—22. View of the larger lake of Moosseedorf, taken standing on the site of the eastern lake dwelling, p. 33.

Pl. VI. Robenhausen, &c.

Fig. 1. Plan of the lake of Pfäffikon, p. 37.—2. Ground plan of part of the Aabach canal, p. 40.—3. Section of the relic-bed, p. 40.—4. Section of the Aabach canal, p. 39.—5. Bank at Himmerich, p. 58.

Pl. VII. Robenhausen, &c.

View of the peat-moor of Robenhausen, taken from Seegraben, p. 37. (The site of the lake dwelling is indicated by a dark bird.)

Pl. VIII. Robenhausen.

Piles of the last settlement but one: round fir timber, p. 44.

Pl. IX. Robenhausen.

Piles of the latest settlement: split oak-wood, p. 44.

Pl. X. Robenhausen.

Figs. 1, 2, 3. Knives of yew-wood, p. 48.—4. Wooden ladle, p. 48.—5. Wooden implement, p. 48.—6. Ring of bark, p. 48.—7. Club of ash-wood, with a stag's horn socket and stone celt, p. 48.—8. Boat ('Einbaum'), p. 49.—9. Flail, p. 49.—10. Bow of yew, p. 49.—11, 12. 'Arpion,' or fishing implement, p. 49.—13. Wooden ladle, p. 48.—14. Wooden club, with a stone celt fixed in it, p. 48.—15. Implement of bark, p. 48.—16. Club, with a celt fixed in it, p. 48.—17. Wooden ladle, p. 48.—18, 19. Implements of stag's horn, p. 53.

Pl. XI. Robenhausen.

Figs. 1, 2. Clubs with celts, p. 50.—3. Yew club, p. 50.—4. Wooden club, p. 50.—5. Bark float, p. 50.—6, 7. Wooden suspension hooks, p. 50.—8. Earthenware spoon, p. 54.—9. Ladle of maple-wood, p. 48.—10. Tub of maple-wood, p. 51.

Pl. XII. Robenhausen, &c.

(Fig. 1 is from Niederwyl; all the others are from Robenhausen.)

Fig. 1. Wooden implement, use unknown, p. 76.—2, 9. Agricultural implements of stag's horn, p. 53.—3. Wooden chisel, p. 51.—4, 5. Stone implement, p. 53.—6. Club of yew-wood, p. 50.—7. Ladle of maple-wood, p. 48.—8. Earthenware vessel, p. 54.—10. Wooden last, p. 51.—11. Knife or chisel of yew, p. 51.

Pl. XIII. Robenhausen.

Fig. 1. Rib bound round with cord, p. 53.—2. Wooden implement, p. 51.—3. Yoke, p. 52.—4. Wooden club with celt, p. 51.—5. Wooden implement, p. 52.—6. Marble cone or hemisphere, p. 54.—7. Pile with a

mortise in the head, p. 52.—8, 9, 11. Earthenware vessels, p. 54.—10. Stag's horn implement, p. 53.—12. Clay cone, p. 54.—13. Flint arrow-head, p. 54.—14. Bone chisel, p. 53.

Pl. XIV. Robenhausen, &c.

Fig. 1. Bone awl, Wangen, p. 67.—2, 6. Balls of string, Robenhausen, p. 52.—3. Perforated wolf's grinder, Wangen, p. 67.—4, 5. Ornamentation on earthenware vessels, Robenhausen, p. 54.—7. Perforated stones, Wangen, p. 67.—8. Stag's horn implement, Wangen, p. 67.—9. Ornamentation on pottery, Wangen, p. 67.—10, 11. Flint arrow-head, Wangen, p. 67.—12. Perforated and sharpened boar's tusk, Moosseedorf, p. 34.—13. Dog's bone perforated, Wangen, p. 67.—14 to 20. Crucibles, Robenhausen, p. 55.—21. Bone awl with head of asphalt, Moosseedorf, p. 34.—22. Bone knife, Moosseedorf, p. 34.—23, 24. Bone fishing implements, Wangen, p. 67.—25. Bone implement, Moosseedorf, p. 34.

Pl. XV. Wangen.

1, 2. Ornamentation on pottery, p. 66.

Pl. XVI. Niederwyl, &c.

(Fig. 2 is from Robenhausen; all the rest from Niederwyl.)

Fig. 1. Wooden platform, p. 74.—2. Section of beds, Rob. p. 42.—3. Section of platforms, Nied., p. 74.—4. Pile-head with mortise, p. 75.—5. Wooden slab with mortise-holes, p. 75.—6. Cone of baked clay perforated, p. 75.—7. Wooden mallet, p. 75.—8. View of the fascine work of part of the lake dwelling, p. 76.

Pl. XVII. Niederwyl.

View of the platform (from a photograph), p. 76.

Pl. XVIII. Wauwyl.

Fig. 1. Section, p. 79.—2. Section, p. 79.—3. Ground plan of part of the settlement, p. 78.—The lower part of the plate contains a map of the district, p. 79.

Pl. XIX. Wauwyl.

On the left side of this plate are the ground plans of the five successive platforms, or layers of timbers, p. 77.—1, 2, 3. Position of piles and timbers, p. 81.—4. Section of the timber platforms, p. 77.—5. Ground plan of a portion, p. 78.—6. Blunt-pointed pile, p. 80.

Pl. XX. Wauwyl.

The upper part is an ideal restoration of the settlement, but, from late discoveries, the huts, in all probability, stood much nearer together, p. 82.

Fig. 1. Stone for stirring melted asphalt, p. 83.—2. Celt hafted in stag's horn, p. 83.—3. Bowl of yew-wood, p. 83.—4, 12. Fragments of pottery, p. 83.—5. Ball of stone (Corn-crusher ?), p. 83.—6. Grinding stone for celts, p. 83.—7. Glass bead, p. 83.—8. Lump of asphalt, p. 84.—9. Knife of yew-wood, p. 84.—10. Piercer or awl of stag's horn, p. 84.—11. Saw made of bone, p. 84.—13. Bead of stag's horn, p. 84.—14, 15. Floats (?), p. 84.—16. Cutting instrument of boar's tusk, p. 84.—17. Flint knife, p. 84.—18, 19, 20. Bone chisels, p. 84.—21 to 25. Bone awls or piercers, p. 84.—26. Barbed harpoon of stag's horn, p. 84.

Pl. XXI. Zug, Wangen, Robenhausen, and Nidau.

Zug. Fig. 1. Section, p. 128.—2. Plan, p. 128.—3. Stone celt, p. 128.—4. Flint arrow-head, p. 128.—5. Stone half cut through for making celts, p. 125. *Wangen.* 6. Earthenware vessel, p. 66.—7, 8. Perforated balls of clay, p. 66.—9. Wooden club, p. 66.—10. Flint saw set in stag's horn, p. 66.—11, 12. Earthenware spindle-whorls, p. 66.—13. Burnt straw (Thatch ?), p. 66. *Robenhausen.* 14. Crucible with portions of melted copper, p. 55.—*Nidau.* 15. Earthenware figure of a lizard, p. 146.

Pl. XXII. Zug, Chevroux, Wauwyl, &c.

Fig. 1. Serrated bone arrow-head, Moosseedorf, p. 34.—2, 3. Earthenware vessels, Zug, p. 131.—4, 25. Implement of stag's horn, Moos., p. 35.—5. Fishhook of boar's tusk, Moos., p. 35.—6. Fishing implement, Wangen, p. 67.—7. Celt hafted in stag's horn, Wauwyl, p. 85.—8, 9, 10, 11. Stags' ribs bifurcate one third of the length, Wauwyl, p. 85—12. Celt handle of wood, Wauwyl, p. 85.—13, 14. Implements of limestone, St. Andreas, Zug, p. 130.—15. Earthenware vessel, Lake of Sempach, p. 271.—16. Spoon of dark-coloured pottery, Cortaillod, p. 151.—17, 18. Ornaments of stag's horn, Wauwyl, p. 85.—19. Part of an earthenware vessel, with three holes on each side of the handle filled with wooden plugs, Cortaillod, p. 151.—20 to 24. Singular bronze implement, use unknown, Chevroux, p. 282.—26. Bronze ornament, Cortaillod, p. 151.—27, 28. Earthenware vessel with feet, Möringen, p. 277.—29. Bronze arrow-head, Estavayer, p. 167.—30. Bronze ornament, Cortaillod, p. 151.—31, 32. Earthenware vessel, with the base perforated, Cortaillod, p. 151.—33, 35. Bronze sickle, with a knob to secure the handle, Cortaillod, p. 151.—34. Handle of an earthenware vessel, Cortaillod, p. 151.

Pl. XXIII. Untersee, &c.

Fig. 1. Ground plan and sections, Allensbach, p. 88.—2. Flint scraper, Bodmann, p. 97.—3, 4. Fruit-crusher (?), Allensbach, p. 90.—5. Portion of a stag's horn sharpened, Bodmann, p. 98.—6. Flint arrow-head, Allensbach, p. 93.

Pl. XXIV. Untersee, &c.

Figs. 1, 4. Net weights (?), Allensbach, p. 94.—2, 3. Stone implements (Fruit-crushers ?), Allensbach, p. 91.—5. Earthenware vessel, Bodmann, p. 99.—6, 7. Stone celt, Allensbach, p. 90.—8, 9. Fruit-crusher (?), Allensbach, p. 90.—10, 11. Stone celt, Allensbach, p. 90.—12, 13. Battle-axe, Bodmann, p. 98.—14. Stone hammer, Bodmann, p. 98.

Pl. XXV. Untersee, &c.

Figs. 1, 7. Half-perforated hammer, Allensbach, p. 91.—2, 3, 8. Stone hammer (?), Allensbach, p. 91.—4. Celt of Diorite, Weiler Hegne, p. 93.—5, 6. Broken stone hammer, Weiler Hegne, p. 94.—9, 10. Corn-crusher, Allensbach, p. 91.—11, 12. Stone celt, Allensbach, p. 92.—13, 14, 17. Unfinished hammer of serpentine, Bodmann, p. 98.—15, 16, 18. Unfinished stone hammer, Allensbach, p. 91.

Pl. XXVI. Ueberlinger See, &c.

Map of the district, in the centre, p. 90.—Water-levels of Maurach, Nussdorf, Unter Uhldingen and Sipplingen, to the left, p. 104.—*a, b, c, d, e,* Flint arrow-heads, Nussdorf, p. 106.

Pl. XXVII. Ueberlinger See.

(All from Nussdorf.)

Figs. 1 to 7. Stone celts, p. 107 to 109.—8. Perforated stone, p. 111.—9. Small stone celt, p. 109.—10. Flint saw, p. 107.—11. Celt, with oval helve hole, p. 110.—12, 13, 14. Flint saws, p. 107.—15. Broken stone hammer, p. 111.—16. *a*, *b*, Stone celt in stags' horn hafting, p. 109.—17. *a*, *b*, Stone celt, p. 110.—18. Chisel-shaped celt, p. 108.—19. Stone celt in stag's horn hafting, p. 109.—20. Flint saw, p. 107.—21. Chisel-shaped celt, p. 108.—22. Stone celt, p. 110.—23. Celt with winglike edge, p. 110.—24. Part of celt, with two helve holes, p. 110.

Pl. XXVIII. Ueberlinger See.

Fig. 1. Stone hammer, Unter Uhldingen, p. 117.—2. Celt, partially bored, Sipplingen, p. 120.—3. Lance-head of serpentine, Sipp., p. 120.—4. Stone celt in process of manufacture, Sipp., p. 120.—5, 6. Stone celts, Nussdorf, p. 108 and 109.—7. Perforated stone disk, Nuss., p. 111.—8. Comb of stag's horn, Nuss., p. 114.—9, 10. Flint saws in wooden handles, Nuss., p. 107.—11. Bone pin, Nuss., p. 113.—12, 13, 14. Bone chisels, Nuss., p. 113.—15. Perforated bear's tooth, Nuss., p. 114.—16, 17. Netting pins made of teeth, Nuss., p. 114.—18. Bone implement, Nuss., p. 113.—19. Perforated tooth of dog or wolf, Nuss., p. 114.—20, 21. Bone hammer-heads, Nuss., p. 114.—22. Hafting for celt of stag's horn, Sipp., p. 121.—23. Bone implement, Nuss., p. 113.—24. Wooden club for a celt, Nuss., p. 110.—25. Iron pruning knife, Unter Uhl., p. 119.—26. Iron lance-head, Unter Uhl., p. 119.—27. Iron arrow-head, Unter Uhl., p. 119.—28. Iron Roman key, Sipp., p. 121.—29. Steel for striking light, Unter Uhl., p. 119.—30. Bronze celt, Unter Uhl., p. 118.—31. Flint celt, Bodmann, p. 99.—32. Flint saw, sickle-shaped, Bodmann, p. 99.—33. Flint lance-head, Sipp., p. 120.

Pl. XXIX. Ueberlinger See.

(Fig. 19 is from Sipplingen; all the rest are from Unter Uhldingen.)

Figs. 1, 2. Bronze armlets, p. 119.—3 to 18. Bronze pins, p. 119.—19. Copper celt, p. 121.—20. Bronze celt, p. 118.—21, 22. Bronze fishhooks, p. 119.—23. Bronze sickle, p. 119.—24. Bronze armlet, p. 119.—25. Bronze chisel, p. 119.—26. Bronze socketed celt, p. 119.

Pl. XXX. Ueberlinger See.

Fig. 1. Earthenware vase, Sipplingen, p. 121.—2. Ornamented cover, Unter Uhldingen, p. 118.—3. Earthenware implement, Sipp., p. 121.—4. Ornamented pottery, Unter Uhl., p. 118.—5, 6. Earthenware vessels, Unter Uhl., p. 118.—7. Ornamented pottery, Unter Uhl., p. 118.—8, 9. Earthenware cups, Unter Uhl., p. 118.—10. Earthenware vase, Sipp., p. 121.—11, 12. Earthenware jars with handles, Sipp., p. 120.—13. Earthenware pipkin, Sipp., p. 121.—14. Funnel-shaped earthenware vessel, Sipp., p. 121.

Pl. XXXI. Ueberlinger See.

Fig. 1. Ornamented cover, Unter Uhldingen, p. 118.—2, 3. Earthenware vessels, Unter Uhl., p. 118.—4. Pipkin, Sipplingen, p. 121.—5. Jar, with perforated vase, Sipp., p. 121.—6. Crucible, Unter Uhl., p. 118.—7, 8. Earthenware vessels, Sipp., p. 121.

Pl. XXXII. Ueberlinger See.

(All Unter Uhldingen.)

Figs. 1 to 13. Bronze knives, p. 119.—14, 15, 16. Bronze lance-points, p. 118.

Pl. XXXIII. Nidau Steinberg.

(All of bronze.)

Figs. 1, 2. Sickles, p. 138.—3 to 6. Knives, p. 139.—7, 8. Chisels, p. 140.—9. Small anvil (?), p. 140.—10. Awl and knife in one, p. 139.—11. Pin, p. 140.—12, 13. Lance-heads, p. 140.—14. Knob, p. 141.—15, 16. Rings, p. 141.

Pl. XXXIV. Nidau Steinberg.

(All of bronze.)

Figs. 1 to 34. Pins, p. 140.—35, 36. Armlets, p. 141.—37. Hook, p. 141.

Pl. XXXV. Nidau Steinberg.

(All of bronze, except Fig. 28.)

Figs. 1, 2. Armlets, p. 140.—3, 4. Lance-heads, p. 140.—5. Celt, p. 138.—6. Broad chisel, p. 140.—7 to 9. Ornaments, p. 142.—8. Knob, p. 142.—10, 11, 12. Arrow-heads, p. 140.—13 to 24. Cutting implements, p. 141.—25, 26, 27. Studs, p. 142.—28. Spiral of gold wire, p. 142.—29. Spiral of bronze, p. 142.—30. Bronze implement, p. 142.

Pl. XXXVI. Nidau Steinberg.

(All of bronze, except Fig. 42.)

Figs. 1, 2. Chisels and awls in one, p. 140.—3. Drill (?), p. 140.—4. Surgical instrument, p. 140.—5. Ligula, p. 140.—6 to 18. Needles, p. 140.—19 to 32. Fishhooks, p. 141.—33 to 41. Rings, p. 141.—42. Ribbed plate of gold, p. 142.

Pl. XXXVII. Nidau Steinberg.

Figs. 1, 2, 3. Slingstones (?) drawn in section, p. 135.—4. Ornament (?) of earthenware, p. 146.—5. Bronze hammer, with an ear, p. 142.—6, 7. Cylinders of earthenware, p. 146.—8. Three bone arrow-heads, p. 147.—9. 'Moon image' of earthenware, p. 146.—10. Bowl of pot-stone, p. 137.—11. Implement of stag's horn, p. 147.—12. Implement of bear's tooth, p. 147.—13. Whistle of stag's horn, p. 147.—14. String of beads of glass and jet, p. 147.—15, 16. 'Moon images' of earthenware, p. 146.—17 to 24. Earthenware spindle-whorls, p. 145.—25. Perforated stone, p. 137.—26. Bead of serpentine, p. 137.—27, 27′, 28. Coloured earthenware vessels, p. 144.—29. Perforated stone, p. 137.—30. Double cup of earthenware, p. 145.—31. Yoke of yew-wood, p. 147.—32. Bronze wire, p. 142.—33. Bronze implement like a snaffle-bit, p. 142.—34, 35. Bronze armlets, p. 141.

Pl. XXXVIII. Nidau Steinberg, &c.

(Fig. 5 is from Meilen; all the rest from Nidau.)

Figs. 1 to 4, 7, Slingstones (?), p. 135.—5. Mealing-stone, Meilen, p. 25.—6, 8 to 13. Earthenware vessels, p. 144.—14. Earthenware ring, p. 145.—15. Stone with an iron ring (Net weight?), p. 135.—16. Conical weight, p. 146.—17. Earthenware spindle-whorl, p. 145.—18, 19, 20. Weights, (?), p. 146.

Pl. XXXIX. Morges, Scheuss, &c.

Fig. 1. Bronze dagger, Chevroux, p. 282.—2. Net weight, Inkwyler See, p. 273.—3. Earthenware funnel-shaped vessel, A la Sauge, p. 283.—4. Bronze pin, Peter's Island, p. 278.—5. Serpentine hammer, Greng, p. 184.—6, 7, 8. Bronze mould for casting celts, Morges, p. 195.—9. Iron ornament, Scheuss, p. 279.—10. Neck of earthenware vessel, with tin ornament, Estavayer, p. 167.—11. Blunt serpentine hatchet, Estavayer, p. 167.—12. Cupped stone, Font, p. 281.

For Comparison. Mainland.

Fig. 13. Cupped stone, Iolimont, p. 282.—14. Cupped stone, Bienne, p. 281.—15. Flint arrow-head fixed in the shaft, Geissbodenmoor, p. 125.

Pl. XL. Möringen.

Fig. 1. Map of the lake of Bienne, p. 132.—2, 5. Iron sword, Möringen, p. 276.—3. Iron fork, Möringen, p. 276.—4. Boat (Einbaum), Möringen, p. 277.

Pl. XLI. Möringen.

Figs. 1, 2. Bronze knives, p. 276.—3. Bronze pin, p. 276.—4, 5. Bronze celt, p. 276.—6. Bone arrow-head, p. 277.—7. Ornamented bronze plate, p. 276.—8. Large wooden mallet, p. 277.—9. Weaver's shuttle of bone, p. 277.—10. Earthenware vessel with spout, p. 277.—11. Bronze awl set in wood, p. 276.—12, 14. Earthenware vessels, p. 277.—13. String of beads, p. 277.—15, 16. Earthenware vessel with the handle *inside*, p. 277.—17. Bronze ornament for suspension, p. 276.—18. Drinking cup, p. 277.

Pl. XLII. Sutz, Lattringen, &c.

Fig. 1. Stone hammer, Sutz, p. 274.—2. Iron lance-heads, Sutz, p. 274.—3. Bronze dagger, Lattringen, p. 275.—4. Bronze sword, Sutz, p. 274.—5. Gold ornament, Little Island, p. 278.—6. Cup of yew-wood with handle, Möringen, p. 277.—7. Bronze sword, between Sutz and Lattringen, p. 275.—8. Bronze 'moon image,' Möringen, p. 276.—9. Bronze knife, Möringen, p. 276.—10, 11. Lances of oak, Sutz, p. 274.—12. Bronze hook, Scheuss, p. 279.—13. Bronze hook, Lattringen, p. 275.—14. Bronze hook, Sutz, p. 274.—15. Bronze pin, Scheuss, p. 279.—16. 'Moon image' of earthenware, Möringen, p. 277.

Pl. XLIII. Cortaillod, &c.

Figs. 1 to 4. Fragments of earthenware vessels ornamented with tin, Estavayer, p. 166.—5. Earthenware vessel also ornamented with tin, Cortaillod, p. 148.

Pl. XLIV. Cortaillod.

(All bronze.)

Fig. 1. 'Neck' of a casting, p. 150.—2, 3. Armillæ, p. 150.—4, 5. Chariot wheel, p. 149.—6, 7, 8. 'Moon images,' p. 150.—9. Arrow-head, p. 150.

Pl. XLV. Cortaillod.

(All earthenware except Figs. 3 and 5.)

Fig. 1. Perforated implement, p. 151.—2, 4, 6, 8, 9. 'Moon images,' p. 151.—3. Spindle-shaped implement of stag's horn, p. 151.—5. Bone arrow-head, p. 151.—7. Earthenware cup, p. 151.

Pl. XLVI. Cortaillod.

(All bronze, except Figs. 11, 12, 14 to 16.)

Figs. 1 to 3. Implements for suspension, p. 150.—4. Armilla, p. 150—5. Ring, p. 150.—6, 7. Portion of armilla (?), p. 150.—8. 'Moon image,' p. 150.—9. Section of Pl. XLIV. Fig. 3, p. 150.—10. Armilla, p. 150.—11, 12. Earring of gold, p. 151.—13. Bronze hook, p. 150.—14. String of beads of bluish-white glass, p. 151.—15. Bronze earring, the drop earthenware, p. 150.—16. Bone (netting ?) implement, p. 151.

Pl. XLVII. Auvernier, Corcelettes, &c.

Fig. 1. Bronze lance-head, Auvernier, p. 154.—2. Bronze ring, Auver., p. 154.—3. Bronze implement, Corcelettes, p. 182.—4. Bronze knife, Concise, p. 182.—5. Bronze knife, Corcelettes, p. 182.—6. Bronze knife, Bevaix, p. 280.—7. Iron lance-head, near Zihlbrücke, p. 283.—8 to 12, 14 to 20. Bronze pins, Corcelettes, p. 182 and 183.—13, 21. Bronze pins, Cortaillod, p. 150.—22. Hairpin of stag's horn, Concise, p. 183.—23. Flint arrow-head, Auver., p. 154.—24. Bronze armilla, Corcell., p. 183.—25. Bronze armilla, Cort., p. 150.—26. Earthenware drinking-cup (in section), Auver., p. 154.—27. Bronze fishhook, Auver., p. 154.—28. Bronze implement, Cort., p. 151.—29. Horn-shaped earthenware vessel, Auver., p. 154.—30 to 34. Earthenware vessels, Auver., p. 155.—35. Mortar (?) of stone, Auver., p. 155.—36. Small bronze chisel, Auver., p. 155.

Pl. XLVIII. Estavayer.

Fig. 1. Bronze chisel, p. 161.—2. Bronze spiral, p. 162.—3 to 14. Bronze pins, p. 160 and 165.—15. Section of part of the cover, XLIX, Fig. 1, p. 163.—16, 17, 21, 23. Bronze armillæ, p. 162.—18. Bronze ring, p. 162.—19, 20. Bronze button (?), p. 162.—22. Bronze spiral, p. 162.—24. Bronze fishhook, p. 162.—25. Flint arrow-head, p. 157—26. Bronze arrow-head, p. 161.—27. Hammer of stag's horn, p. 157.—28. Bronze celt, p. 166.—29. Stone hammer, p. 158.—30. Celt of serpentine, p. 163.—31. Bronze sickle, p. 162.

Pl. XLIX. Estavayer, &c.

(All from Estavayer, except Figs. 5 and 6.)

Fig. 1. Earthenware cover ornamented with tin, p. 162.—2, 3. Bronze knives, p. 160.—4. Bronze dagger blade, p. 161.—5. Hatchet of stag's horn, La Crasaz, p. 164.—6. Flint tongue, La Crasaz, p. 164.—7 to 15. Bronze knives, p. 160.

Pl. L. Estavayer and Lake of Morat.

Fig. 1. Bar of tin, Est., p. 166.—2. Bronze arrow-head, Est., p. 166.—3. Bronze saw, Est., p. 166.—4. Bronze ferrule, Est., p. 166.—5. Bronze armlet, Est., p. 166.—6. Bronze ornament, Est., p. 166.—7, 8. Disk of elk's horn, Est., p. 166.—9, 10. Bronze nail with socket, Est., p. 166.—11. Bronze boss, Est., p. 166.—12, 13. 'Slingstones,' Est., p. 166.—14. Tinned vessel (section), lake of Morat (Guevaux), p. 285.—15. Earthenware vessel, lake of Morat, p. 285.

Pl. LI and LII. Montellier.

The whole of the specimens drawn on these two plates consist of earthenware vessels and spindle-whorls from Montellier, on the lake of Morat; described pages 191 and 192.

Pl. LII. (A). Montellier.

Figs. 1, 2, 3. Fragments of a mould for casting rings. *Figs.* 2, 3, are the front and back of the same piece, p. 193.—4. Trellis-shaped implement of black earthenware, p. 192.—5. Fragment of pottery ornamented with tin, p. 193.—6. Flint arrowhead, p. 193.—7. Bronze arrow-head, p. 193.—8. Fragment of a ring of tin, p. 193.—9. Small armlet of tin, p. 193.—10. Sewing needle of horn, p. 193.—11. Bronze ornament for suspension, p. 193.—12, 13. Bronze knobs, p. 193.—14. Bronze ornamented disk, p. 193.—15, 16. Bronze screws, p. 193.—17. Thin bronze plate, p. 193.—18. Fragment of bronze buckle, p. 193.—19. Bronze ring, p. 193.—20, 21, 22. Bronze fishhooks, p. 193.—23. Bronze ornament in the shape of a crescent moon, p. 193.—24. Amber bead, p. 193.

Pl. LII. (B). Montellier.

Fig. 1. Earthenware dish, perforated, p. 193.—2. Bronze knife, p. 193.

Pl. LIII. Concise, &c.*

Fig. 1. Plan of the lake of Neuchâtel, in the neighbourhood of Yverdon, p. 168.—2. Section of the ground at Les Uttins, p. 168.—3. Plan of Concise harbour, p. 169.—4, 5, 6, 7, 8. Stag's horn haftings for celts, p. 170.—9, 10. Stone celt, p. 171.—11. Flint saw, p. 171.—12. Hatchet-hammer of stag's horn, p. 171.—13. Hammer of stag's horn, p. 171.—14, 15, 16. Hatchet-hammer of stag's horn, p. 171.—17. Bronze sword, p. 176.—18. Spiral bronze wire, p. 175.—19. Necklace bead (?), p. 175.—20. Bead of stag's horn, p. 175.

Pl. LIV. Concise, &c.

Figs. 1, 2. Hatchet-hammers of stone, p. 172.—3. Perforated pebble, p. 172.—4, 5. Perforated pebbles (spindle-whorls ?), p. 173.—6. Spindle-whorl, p. 173.—7, 8, 9. Flint arrow-heads, p. 177.—10. Bone piercer, p. 173.—11. Piercer made of boar's tooth, p. 173.—12 to 17. Bone arrow-heads, p. 177.—18. Bone lance, p. 177.—19. Bone bead, (?) p. 175.—20, 21. Hairpins of stag's horn, p. 174.—22, 23, 24. Bone hairpins, p. 174.—25. Plate of enamel of tusk, p. 175.—26, 27. Harpoons of stag's horn, p. 177.—28, 29. Implements of boar's tusk, p. 179.—30, 31, 32. Bone pottery tools, p. 180.—33. Bone chisel, p. 180.—34. Bone tool for pottery, p. 180.—35. Bone needle, p. 174.—36. Fragment of jet bracelet, p. 175.—37. Amulet (?) of boar's tusk, p. 175.—38. Bone chisel, p. 179.—39. Oval plate of enamel, p. 175.—40. Bone gouge, p. 180.—41. Bone pottery tool, p. 180.

Pl. LV. Concise, &c.

Fig. 1. Part of clay ring, p. 178.—2, 3, 5 to 9, 11, 12. Earthenware vessels, p. 178.—4. Earthenware ladle, p. 178.—10. Goblet of stag's horn, p. 178.—13, 14. Drinking vessels of stag's horn, p. 178.—15. Boar's tusk partially perforated, p. 175.—16. Lozenge-shaped flint, p. 177.—17, 18. Bone potters' tools, p. 179 and 180.—19. Bronze button, p. 175.—20. Bronze knife, p. 181.—21. Implements made of a rib, p. 179.

* The objects drawn on this and the two following plates are described in M. Rochat's account of the lake dwellings in the neighbourhood of Yverdon, and apparently refer to the specimens in the interesting museum there. From his notice, which is given nearly in full in the present volume, it seems as if the whole of the objects drawn are from Concise, though this is not definitively stated; if, however, any of them are not from Concise, they must be from Corcelettes, and, as the two places are at no great distance apart, this small amount of uncertainty is of less importance.—[Tr.]

Pl. LVI.

Plan of the lake dwellings in the lakes of Neuchâtel, Bienne, and Morat.

Pl. LVII. Lake of Bourget.

Fig. 1. Earthenware vessel with Greek pattern, p. 203.—2. Perforated earthenware vessel, p. 203.—3. Earthenware vessel with spout, p. 203.—4. Earthenware vessel with rope ornament, p. 203.—5. Fragment of pottery, p. 203.—6. Earthenware spindle-whorl, p. 203.—7. Earthenware ring, p. 203.—8, 9. Earthenware beads, p. 203.

Pl. LVIII. Mercurago.

Figs. 1 and 2. Bronze pin, p. 210.—3. Bronze pin, p. 211.—4. Bronze lance-head, p. 210.—5, 6. Flint tongue, p. 211.—7 to 11. Flint arrow-heads, p. 211.—12, 13, 22. Fragments of pottery, p. 211.—14, 16, 17. Earthenware vessels, p. 211.—15. Earthenware disk, p. 210.—18. Section of the ground with piles, p. 211.—19, 20. Wooden wheels, p. 213.—21. Ground plan, p. 211.—23. Boat, p. 210.

Pl. LIX. Terramara.

Figs. 1 to 6. Paalstabs and lance-heads of bronze, p. 230.—7. Cylinder-shaped implement of earthenware, p. 231.—8. 'Slingstone' (?) of porphyry, p. 229.—9. Mould for casting combs, p. 231.

Pl. LX. Terramara.

Figs. 1, 2. Piles in section, p. 226.—4, 5. Ground plans, p. 226.—6. Hearth-stone (?), p. 227.—7 to 10. Earthenware vessels, p. 227.

Pl. LXI. Terramara.

Figs. 1, 2. Earthenware vessels, p. 227.—3 to 10. Variously shaped handles to earthenware vessels, p. 228.—11, 13, 14. Fragments of pottery ornamented, p. 228.—12. Fragment of pottery inlaid with bronze, p. 228.

Pl. LXII. Terramara.

Figs. 1, 2. Bronze pins, p. 230.—3 to 6. Bronze implements (*Figs.* 5 and 6 are set in wooden handles), p. 229.—7 to 9. Implements of bone and horn, p. 229.—10. Bronze chisel, p. 229.—11, 12, 13. Bone implements, p. 229.—14, 18. Fragments of bronze 'moon images' (?), p. 230.—15. Bone implement, p. 229.—16, 17. Bronze sickles, p. 229.—19. Bronze arrow-head, p. 230.—20, 24, 25, 28 to 30. Bone arrow-heads, p. 230.—21, 22, 23. Bronze pins, p. 230.—26, 27. Bone implements, p. 229.

Pl. LXIII. Terramara.

Figs. 1 to 5. Bronze dagger-blades, p. 230.—6, 15. Bone combs, p. 229.—7. Bronze comb, p. 229.—8, 9, 10. Mould for casting, p. 230.—11. Bone implement, p. 229.—12 Bronze lance-head, p. 230.—13, 14. Horn implement, p. 229.

Pl. LXIV. Terramara.

Figs. 1 to 10. Wooden implements (Castione), p. 229.—11. Basket bottom, p. 229.—12 to 16, 18. Earthenware spindle-whorls, p. 231.—17. Spindle-whorl of stag's horn, p. 231.—19. Disk of earthenware, p. 231.

Pl. LXV.

N.B.—The specimens drawn on this plate are from the mainland: they are *for comparison* with those of the lake settlements.

Fig. 1. Earthenware vessel, San Martino, p. 215.—2. Bronze sword, Lago di Viverone, p. 215.—3. Serpentine knife, Cumarola, p. 237.—4, 7, 8, 9. Flint arrow-heads, Cumarola, p. 237.—5, 6. Tools of serpentine, Cumarola, p. 237.—10. Earthenware implement, Cumarola, p. 237.—11, 12. Bronze arrow-heads, Cumarola, p. 237.—13. Bronze celt, Cumarola, p. 237.—14. Bronze implement, Cumarola, p. 237.—15 to 20. Vessels and fragments of earthenware, Sesto Calende, p. 238.—21 to 25. Stone celts and tools, Imola, p. 238.

Pl. LXVI. Peschiera.

(All bronze.)

Figs. 1, 3, 4. Daggers, p. 221.—2, 5 to 9. Spear-heads, p. 221.—10 to 14, 16 to 22. Pins, p. 221.—15, 23. Needles, p. 221.

Pl. LXVII. Peschiera.

Figs. 1, 2, 3. Small bronze harpoons, p. 221.—4, 11 to 14. Bronze pins, p. 221.—5. Bronze armilla, p. 221.—6, 9. Bronze spiral, p. 221.—7, 8. Bronze fibulæ, p. 221.—10. Bronze knife, p. 221.—15, 16, 17. Copper tools, p. 221.—18. Bronze tube engraved with spiral, p. 221.—19. Bronze celt or chisel, p. 221.—20. Granite disk (slingstone?), p. 221.—21. Plan of Peschiera, p. 221.

Pl. LXVIII.

N.B.—This plate represents specimens drawn *for comparison* with those of the lake dwellings. *Figs.* 1 to 28 are all drawings of *copper* implements from the mainland in Hungary, p. 219.

Pl. LXIX. Marin.

(All iron.)

Figs. 1 to 9, 13. Fibulæ, p. 255.—10 to 12. Clasps of buckle, p. 255.

Pl. LXX. Marin.

Figs. 1 to 5. Clasps of iron buckle, p. 255.—6. Ringed iron staple, p. 253.—7, 8, 9, 10, 11. Iron rings for buckles (?), p. 255.—12, 13, 15 to 21. Iron studs, knobs, or nails, p. 256.—14. Part of iron buckle (?), p. 255.—22. Part of iron buckle, p. 255.—23. Mat of flax or bast, p. 242.

Pl. LXXI. Marin.

Figs. 1 to 5. Iron swords and sheaths, p. 242.—6, 7. Iron sickles, p. 256.—8. Steel for striking light (?), p. 253.—9, 10. Iron knives, p. 253.—11 to 16. Spear-heads of iron, p. 248.—17. Small iron dagger (?), p. 253.—18. Three-pronged iron fork, p. 253.—19, 20. Iron hedging bills, p. 253.—21. Iron gouge, p. 253.—22, 23, 24. Iron celts and hatchet, p. 253.—25. Stone and iron anchor, p. 254.—26. Iron shears, p. 253.—27. Iron currycomb, p. 253.—28. Iron fibula, p. 255.

Pl. LXXII. Marin.

(Colonel Schwab's Museum.) N.B.—The &c. after the word Marin, at the foot of this plate, has been inserted in error: *all* the specimens are from Marin.—*Fig.* 16, ½; 1 to 3, ½; 5, 13, 15, 18, 19, 24 to 27, ½; 14, 17, ¼; 28, ⅛; and the rest full size.

Figs. 1, 2. Iron spear-heads, p. 248.—3. Iron knife, p. 253.—4. Bone die, p. 242.—5. Iron bit, p. 254.—6. Part of blue glass armlet, p. 241.—7, 8, 9.

Glass beads, p. 241.—10. Bone ornament, p. 242.—11. Incised tooth, p. 242.—12. Glass ball (head of pin?), p. 242.—13. Iron Roman key, p. 254.—14. Iron taper drill, p. 254.—15. Iron linch-pin, p. 254.—16, 19. Iron hook, p. 254.—17. Iron pliers, p. 255.—18. Iron hatchet or gouge, p. 253.—20. Stone ball for a game (?), p. 240.—21. Earthenware ring polished black, p. 241.—22, 23. Parts of iron sheaths, p. 242.—24, 25. Iron fibulæ, p. 255.—26. Iron fibula with bronze knobs, p. 255.—27. Scraping iron, p. 254.—28. Bronze needle, 241.

Pl. LXXIII., LXXIV., LXXV., LXXVI.

All are drawings of iron swords and sheaths from Marin; nearly all of them in the collection of Colonel Schwab; *Fig.* 6, Pl. LXXVI. is in that of Professor Desor. The 'marks' on this plate, *Figs.* 11 to 14, are drawn of the full size; all the other figures on these four plates are half size, with the exception of the swords drawn Pl. LXXIV., which it was of course impossible to get into an octavo plate, and of which only the two extremities have been represented half size, p. 242.

Pl. LXXVII. Marin. (Iron.)

Spear-heads. *Figs.* 3, 4, in the collection of Professor Desor. *Figs.* 1, 2, 5, in that of Colonel Schwab. *Fig.* 1 weighs about 8¼ ounces troy, and *Fig.* 2 nearly 10 ounces troy, p. 248.

Pl. LXXVIII. Marin. (Iron.)

Figs. 1 to 4, and 7 to 9. Spear-heads, p. 248.—5, 6. Sickles, p. 256.

Pl. LXXIX. Marin. (Iron.)

Figs. 1 to 7. Spear-heads, p. 248 (*Fig.* 1 weighs 14 ounces troy).— 8. Shield plate, or strap, p. 252.

Pl. LXXX. Marin.

Fig. 1. Bronze hatchet, p. 240.—2, 3. Bronze pliers, p. 241.—4, 5, 6. Iron handles (?), p. 253.—7. Iron staple, p. 253.—8. Iron ring and staple, p. 253.—9. Bronze fibula, p. 241.—10, 11, 12. Iron plate (shield-plate?), p. 252.—13, 14. Iron shield plate, or strap, p. 252.—15, 16. Lance-shaft ferrules, p. 251.—17. Bronze ring, p. 241.—18. Blue glass ring, p. 241.—19. Bronze spiral with glass bead, p. 241.—20. Bronze ring, p. 241.—21. Iron wire, p. 253.—22, 23. Bone implement, p. 242.—24. Iron ring, p. 253.—25. Iron hook, p. 253.—27. Bronze ring, p. 241.—28, 29. Iron rings, p. 253.

(N.B. *Fig.* 26, Bronze ring from Montellier, has been drawn on this plate in error, p. 193.)

Pl. LXXXI. Marin.

Fig. 1. Iron ladle, p. 253.—2. Glass bead, p. 241.—4, 5, 8, 10. Bronze plate, p. 241.—7. Bronze ring, p. 241.—9. Bronze cauldron, with iron rings for handles, p. 240.—11. Bronze ring with shank, p. 241.—12 to 15. Iron hornlike implements, p. 252.—16, 17. Gaulish gold coin (Philipp's money), p. 256.—18, 20 to 24. Gaulish coins ('Potin'), p. 256.—19. Silver coin of Massilia, p. 256.

(N.B. *Figs.* 3 and 6, An iron plate, clamped on wood, from Nidau, have been drawn on this plate in error.)

Pl. LXXXII. Robenhausen and Wangen.

Various specimens of plaited 'bast' and flax, see p. 325.

PL. LXXXIII. ROBENHAUSEN AND WANGEN.

Platted 'bast' and flax, and thread, string, and rope of flax, see p. 325.

PL. LXXXIV. ROBENHAUSEN AND WANGEN.

Platted and woven flax, see p. 329.

PL. LXXXV. ROBENHAUSEN.

Fig. 1. Pocket sewed on to coarse cloth, p. 330.—2. Net, p. 328.

PL. LXXXVI.

Fig. 1. Flax plat (top of a cap?), Wangen, p. 330.—2. Strap or bag of a sling made of flax, Cortaillod, p. 330.

PL. LXXXVII. and LXXXVIII.

Plants and seeds of the lake dwellings; see the full description of the figures in the abridgement of Professor Heer's Treatise, p. 336.

PL. LXXXIX. EBERSBERG. (Mainland. For Comparison.)

Fig. 1. Sling-stone (?) of porphyry, p. 373.—2, 3. Clay spindle-whorls, p. 371. —4. Bronze ring, p. 374.—5, 6. Stone celts, p. 372.—7. Part of 'moon image' of red sandstone, p. 372.—8, 9. Earthenware vessels, p. 369.—10. 'Restoration' of the forms of pottery, p. 369.—11. Bone lance-head, p. 373.—12. Bronze knife, p. 374.—13, 14, 18, 19. Bronze pins, p. 374.—15, 16, 17. Bronze chisels, p. 374.

PL. XC. EBERSBERG. (For Comparison.)

Figs. 1 to 15. Ornamentation on pottery, all drawn half size, p. 369.— 16. Impression of wattlework on the clay coverings of the huts, p. 371.

PL. XCI. EBERSBERG. (For Comparison.)

Fig. 1. Earthenware vessel perforated, p. 370.—2. Glass bead, p. 373.— 3. Cup and ring, p. 371.—4. Earthenware vessel, p. 369.—5. 'Moon image,' terra cotta, p. 372.—6. Bone lance-head, p. 373.—7 to 9, 14 to 16. Bronze pins, p. 374.—10. Bronze knife, p. 374.—11. Earthenware loom weight, p. 371.—12, 20, 21. Earthenware spindle-whorls, p. 371.—13, 23. Bronze spiral, p. 374.— 17. 'Moon image,' sandstone, p. 371.—18. Bronze finger-ring, p. 374.— 19. Bronze earring, p. 374.—22. Corn-crusher of stone, p. 372.—24. Celt of nephrite, p. 372.—25. Bronze arrow-head, p. 374.

PL. XCII. UETLIBERG and WINDISCH. (Mainland. For Comparison.)

(N.B.—Figs. 1 to 10 from Uetliberg. Figs. 11 to 16 from Windisch.)

Fig. 1. Red pottery coarsely ornamented, p. 376.—2. Black pottery, p. 376. —3. Bronze chisel, p. 376.—4. Stone celt, p. 376.—5. Bone piercer, p. 376.— 6. Bronze pin, p. 376.—7. Four bronze ornaments, p. 376.—8. Small bronze wheel, p. 376.—9. Handle of a bronze 'moon image' (?), p. 376.—10. Bronze ornament, p. 376.—11. Flint tongue or knife, p. 377.—12. Flint scraper, p. 377. —13. Stone celt, p. 377.—14, 15. Corn-crushers of stone, p. 377.—16. Perforated bear's tooth (amulet?), p. 377.

Pl. XCIII. Irish Crannoges.

Fig. 1. Section of crannoge in Ardakillin Lough, p. 384.—2. Ground plan of a crannoge in Drumaleague Lough, p. 384.—3. Section of another crannoge in the same lake, p. 384.—4, 5, 6. Bone cloak-pins, Ballinderry, p. 386.—7. Head of bronze pin, Ardakillin, p. 387.—8. Ringed bronze pin, Dunshaughlin, p. 387.—9. Sandstone mould for casting celts, Lough Scur, p. 387.—10. Iron spear-head, Lagore, p. 387.—11, 12. Double-edged iron sword, Lagore, p. 387.—13. Scimitar-shaped iron blade, Lagore, p. 387.—14. Iron knife, Lagore, p. 387.

Pl. XCIV. Irgenhausen, &c. (Supplementary Plate.)

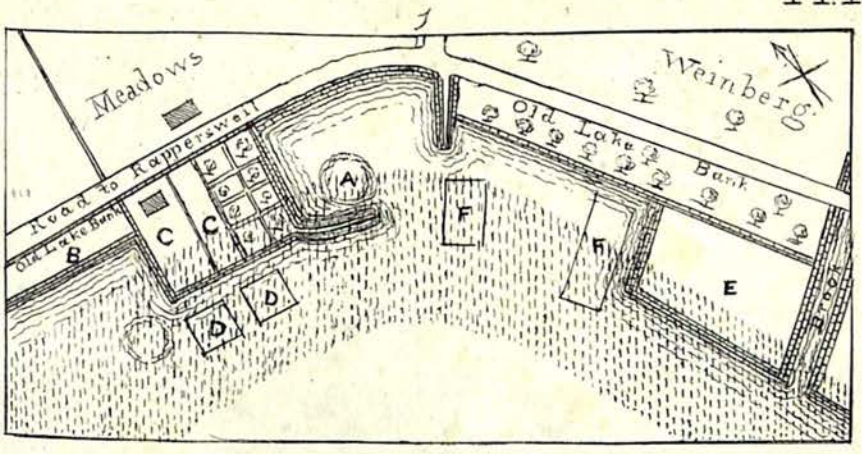
Fig. 1. Fragment of pottery, with peculiar ornament, Wangen, p. 67.—2, 2*a*. Embroidered cloth, Irgenhausen, p. 59.—3. Agricultural tool of stag's horn, Robenhausen, p. 53.—4. Bronze celt, Unter Uhldingen, p. 118.

Pl. XCV. Cortaillod, &c. (Supplementary Plate.)

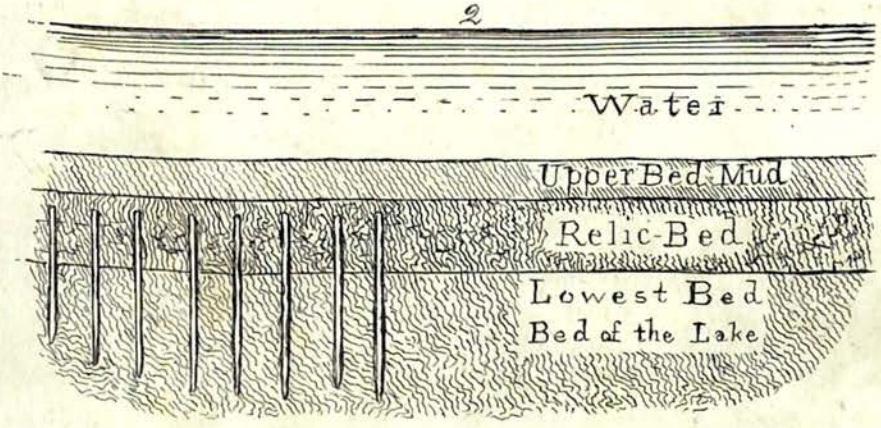
Figs. 1, 2. Earthenware vessel ornamented with tin, Cortaillod, 149.—3, 4, 5. Round bronze plates, Möringen, p. 276.—6. Mat of flax or bast, Robenhausen, p. 53.—7. Stone beads, Bodmann, p. 100.

Pl. XCVI. Latest Discoveries, St. Aubin, &c.

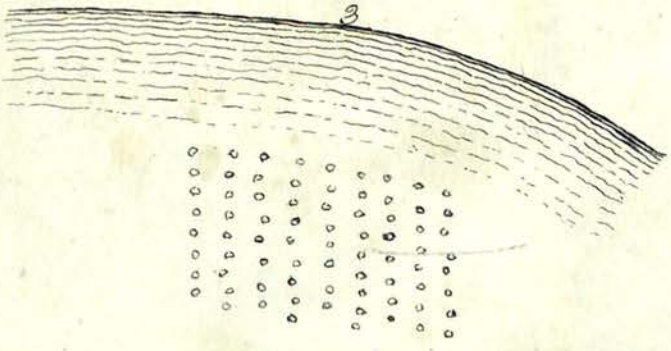
Figs. 1, 2. Bronze ring, Les Roseaux, p. 403.—3. Bronze and iron knife, Estavayer, p. 402.—4, 5, 6. Maker's marks on iron swords, Marin, p. 402.—7. Belemnite with a circular groove, St. Aubin, p. 402.—8, 9. Bone of a stork made into a needle-case, Marin, p. 403.—10. Part of the blade of an iron sword, Marin, p. 402.—11. Flint arrow-head re-worked, St. Aubin, p. 402.—12. Large bead of stag's horn, Wangen, p. 403.



GROUND PLAN

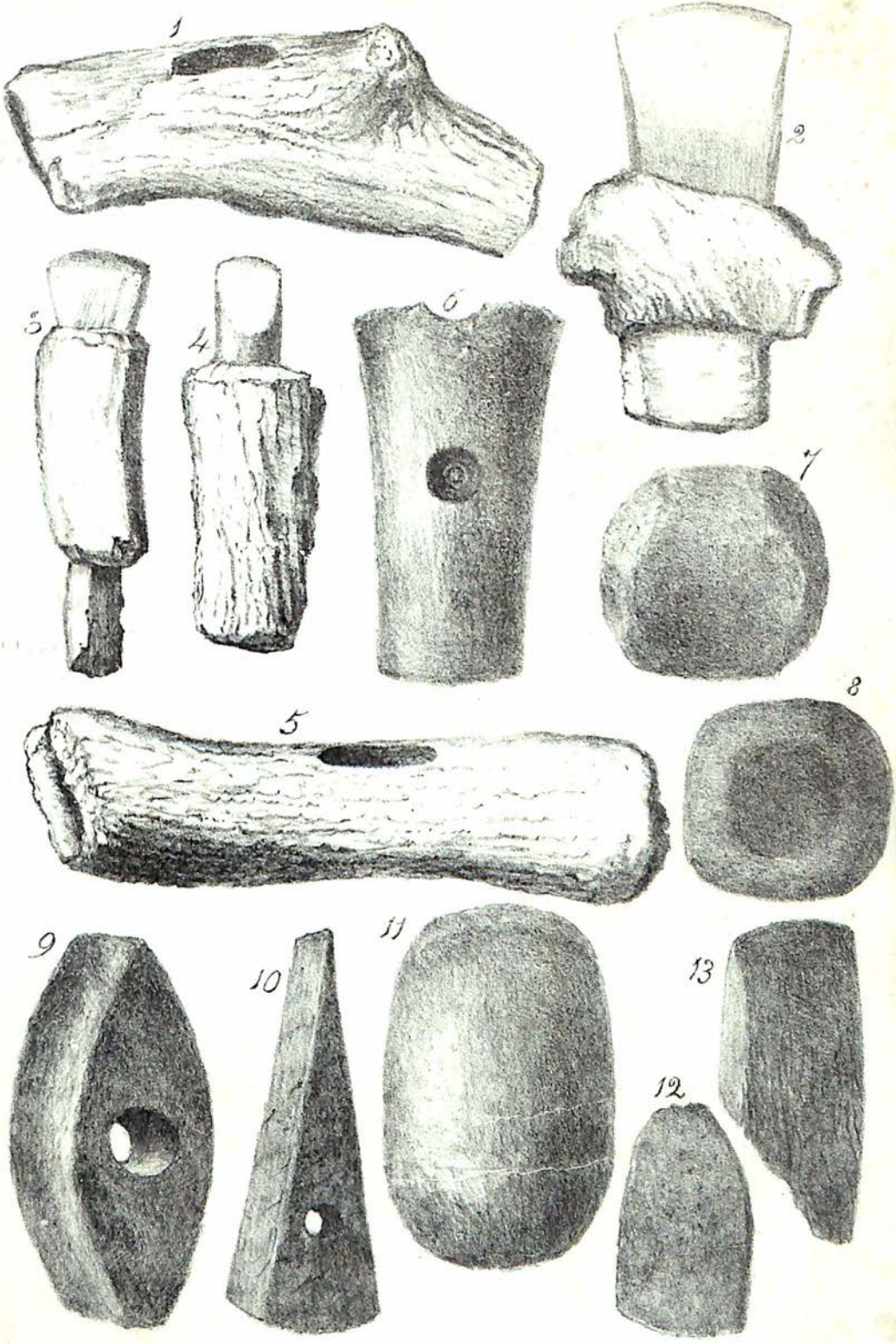


SECTION

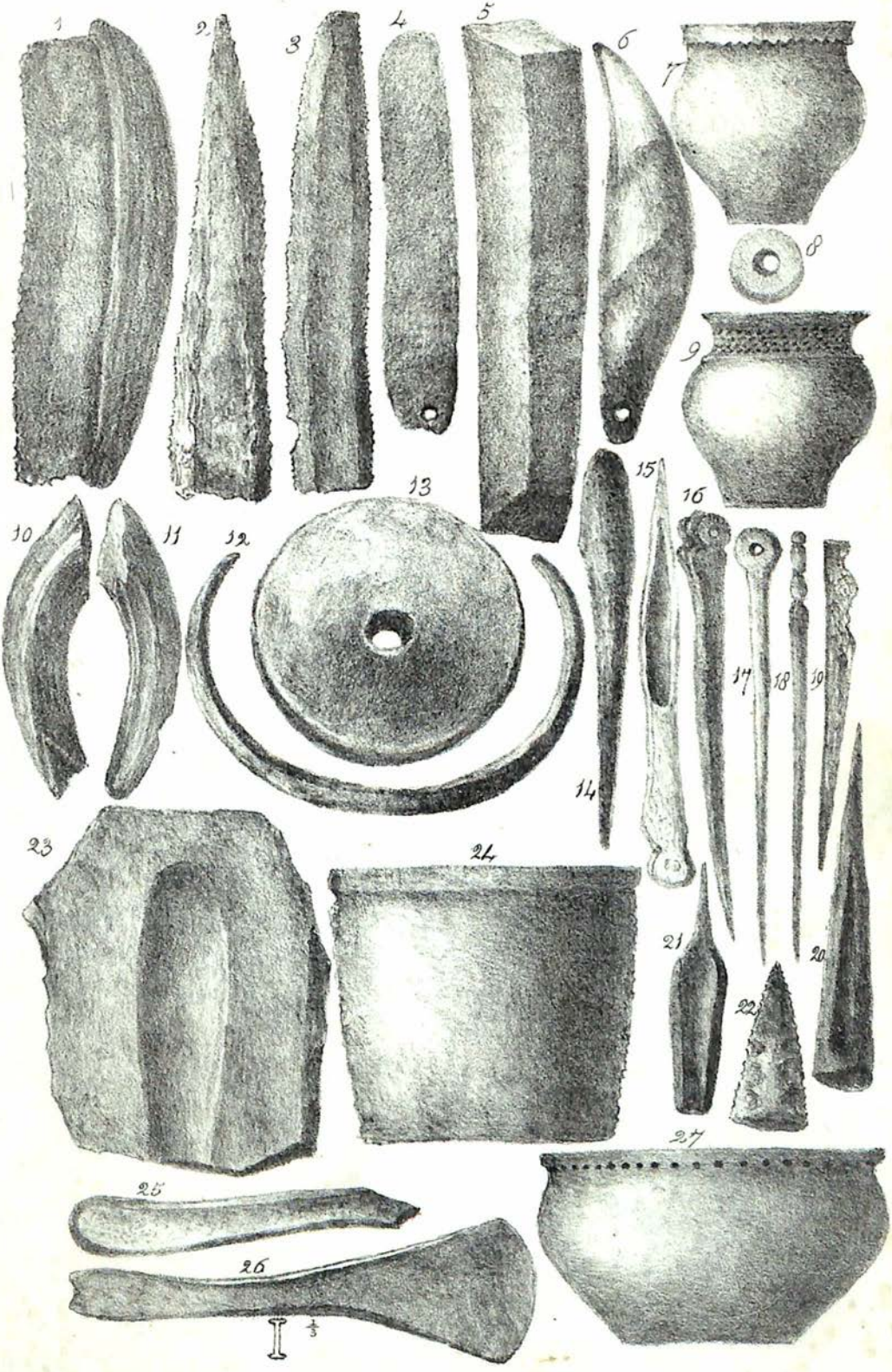


ARRANGEMENT OF THE PILES

MEILEN.



MEILEN.



MEILEN.

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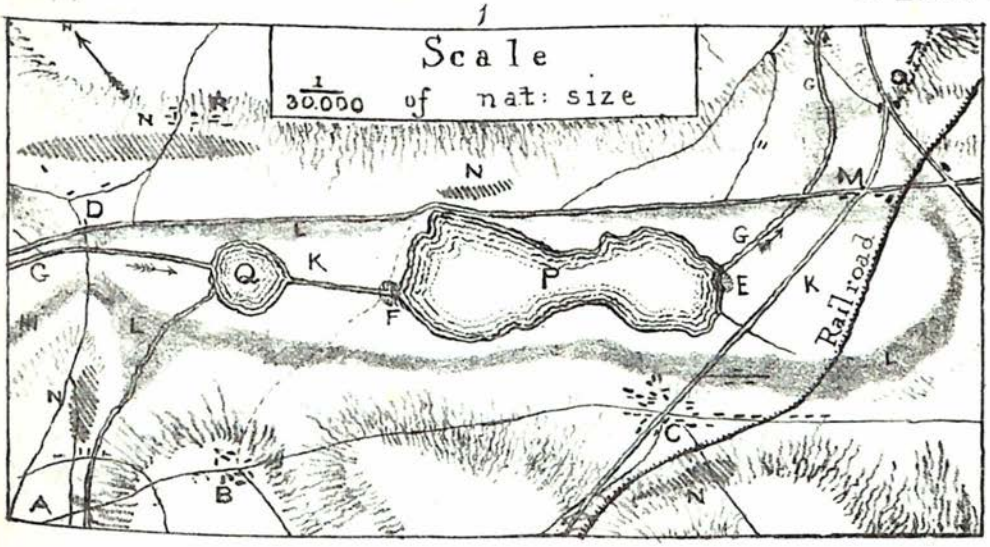

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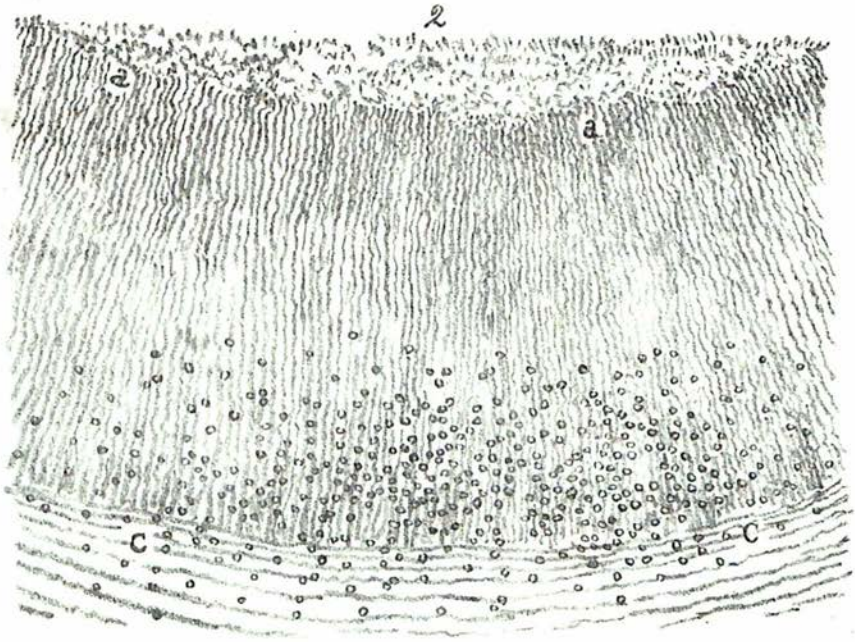

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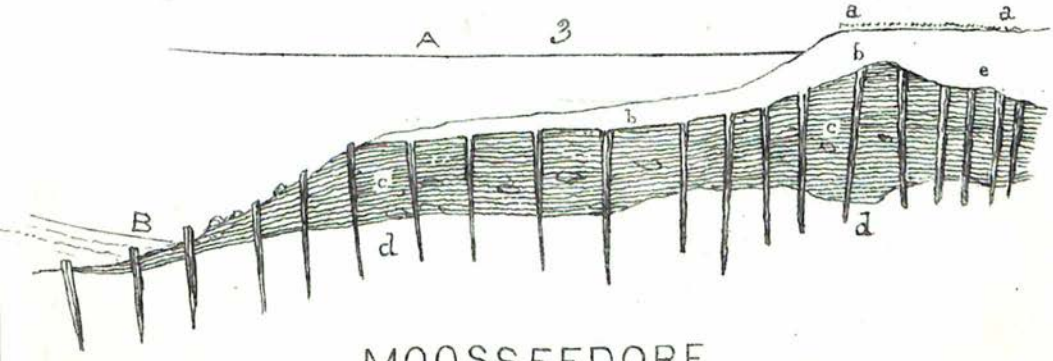

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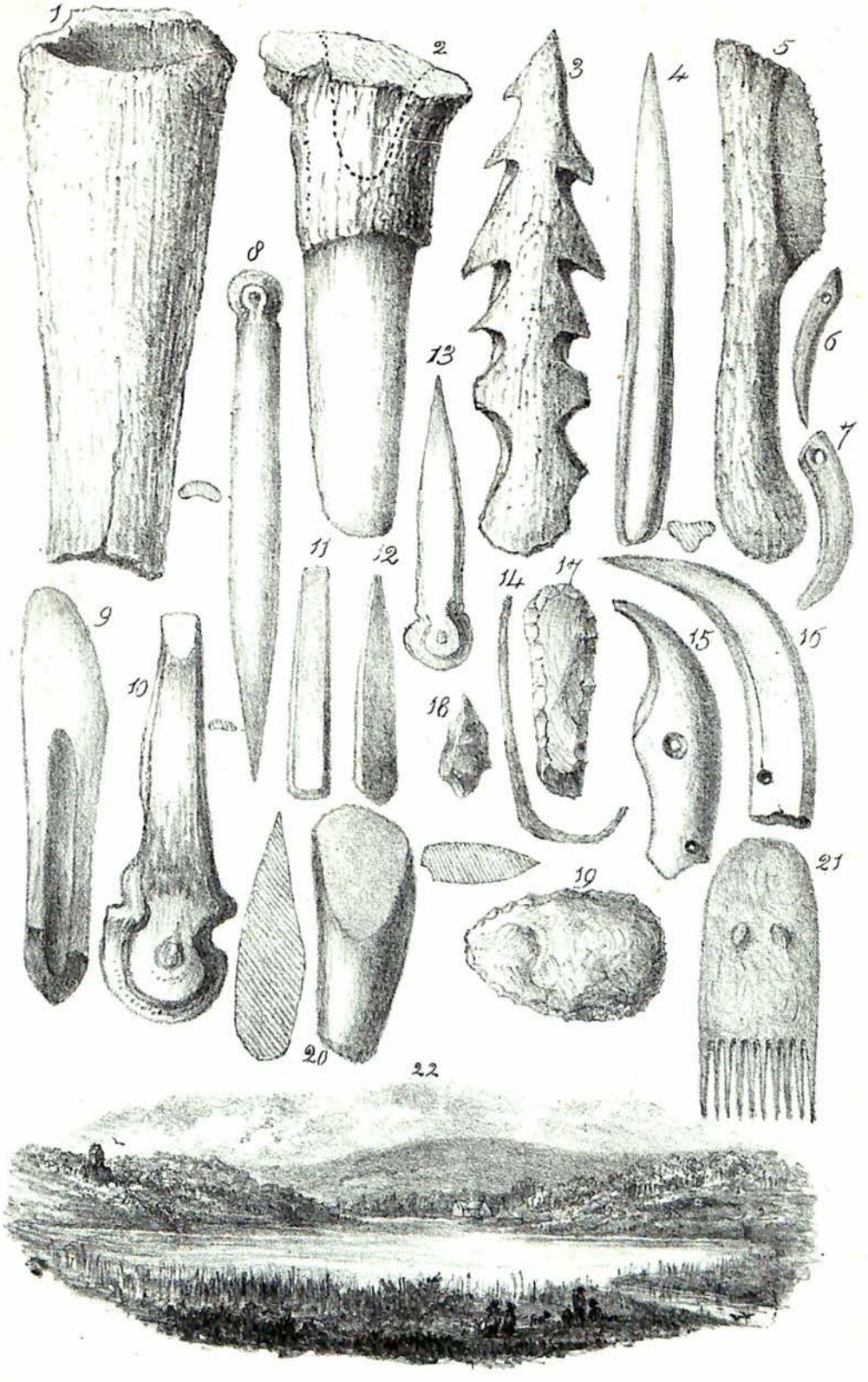

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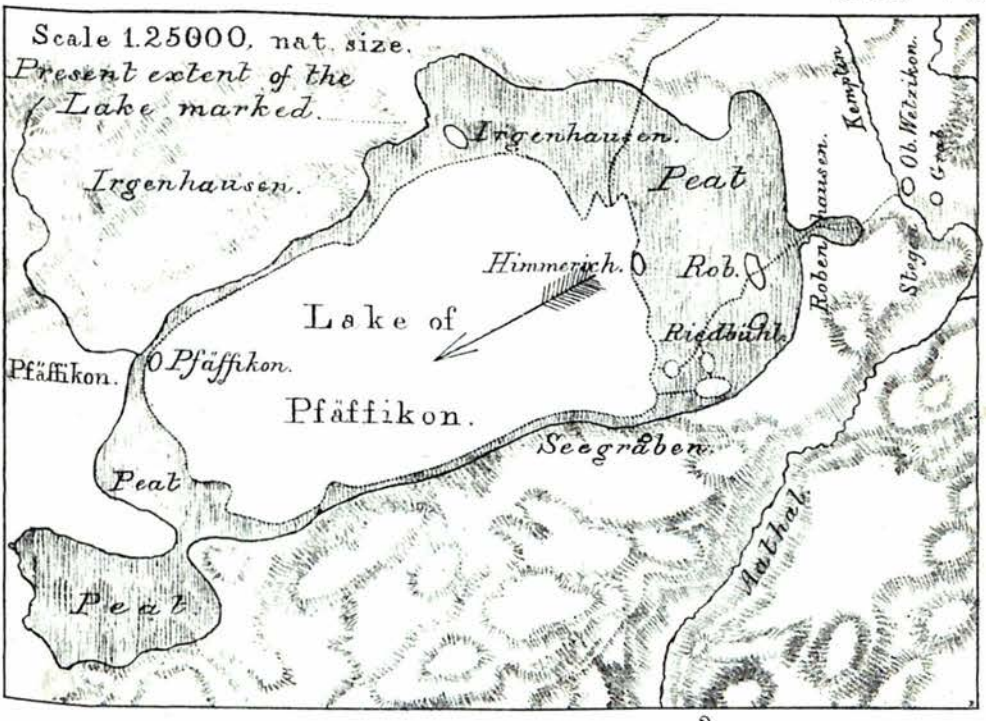
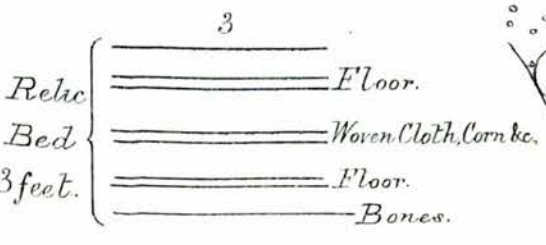
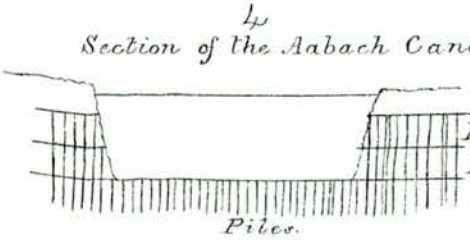
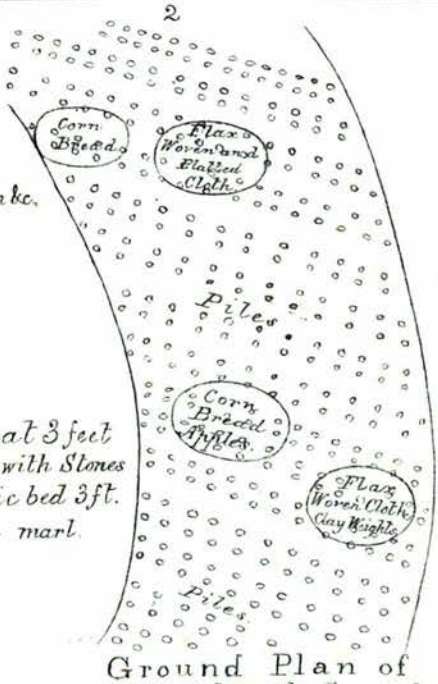
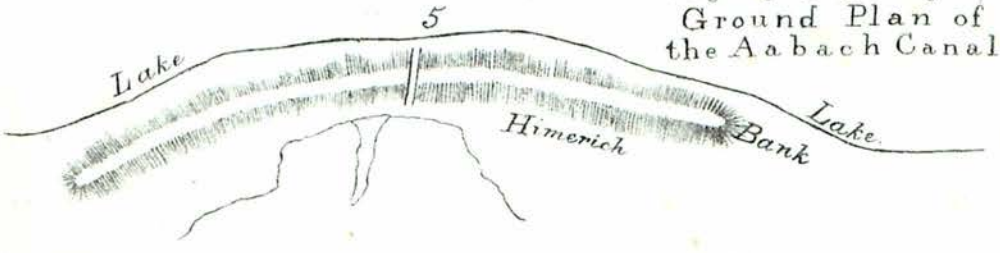




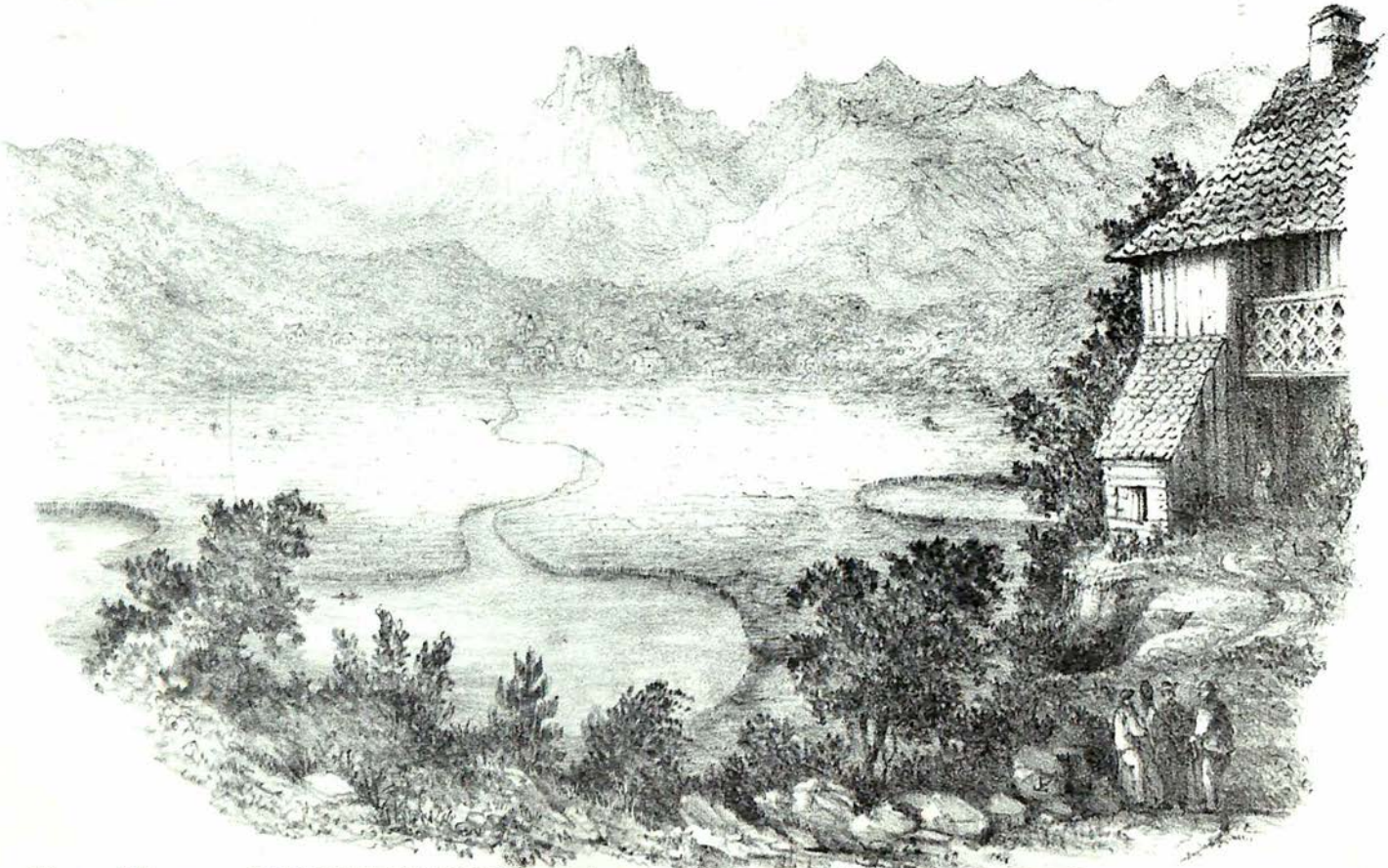




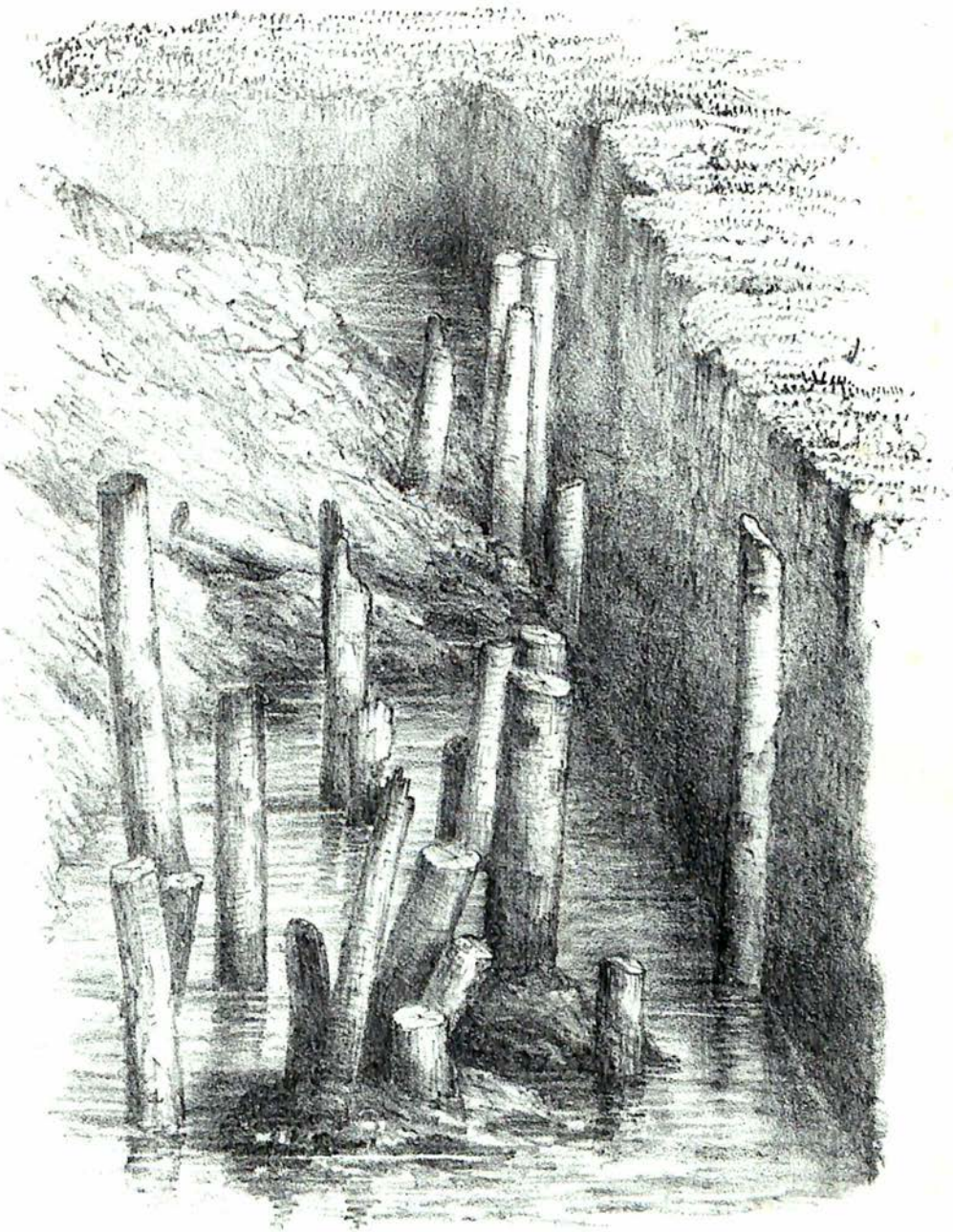
Ground Plan of the Aabach Canal.



ROBENHAUSEN.



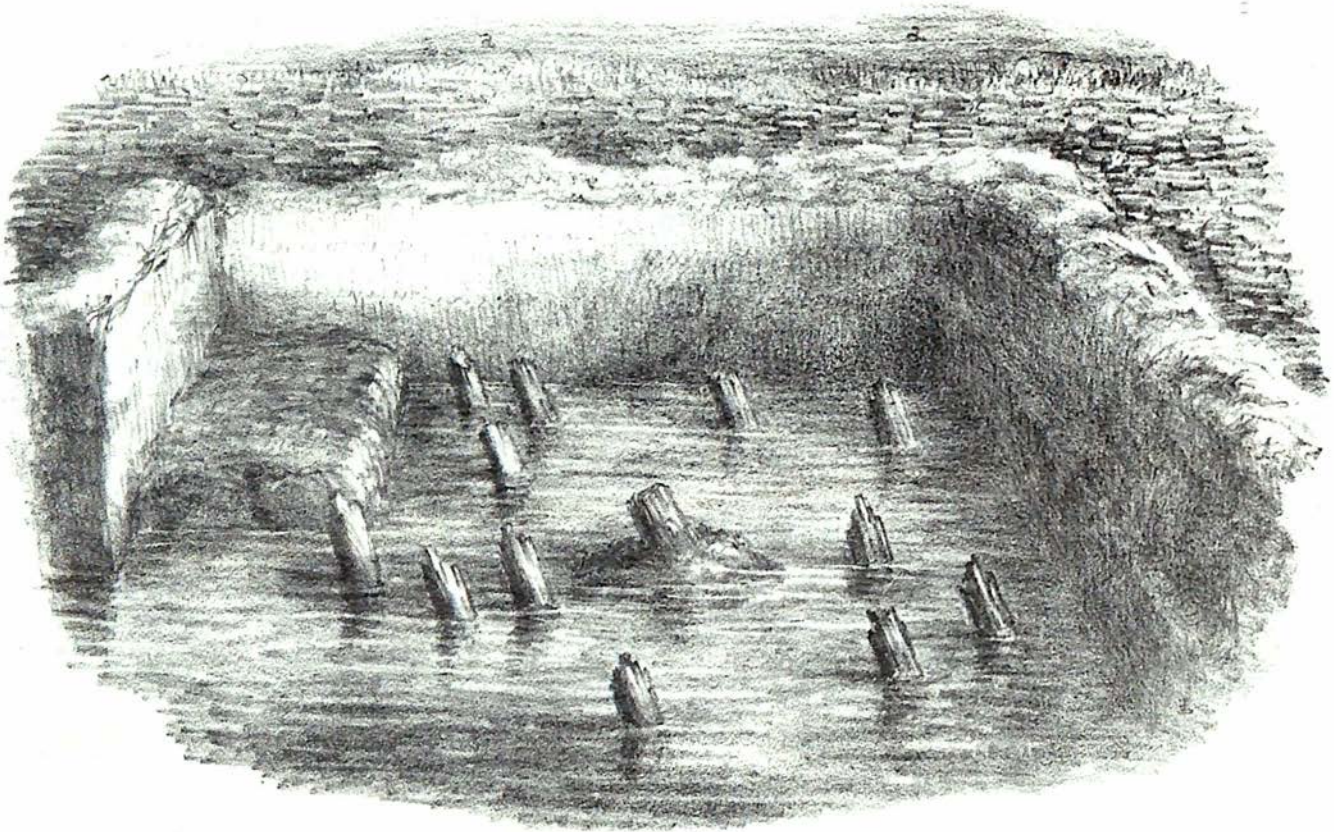
Peat Moor of ROBENHAUSEN *with part of the* LAKE PFÄFFIKON. *as seen from*



ROBENHAUSEN.

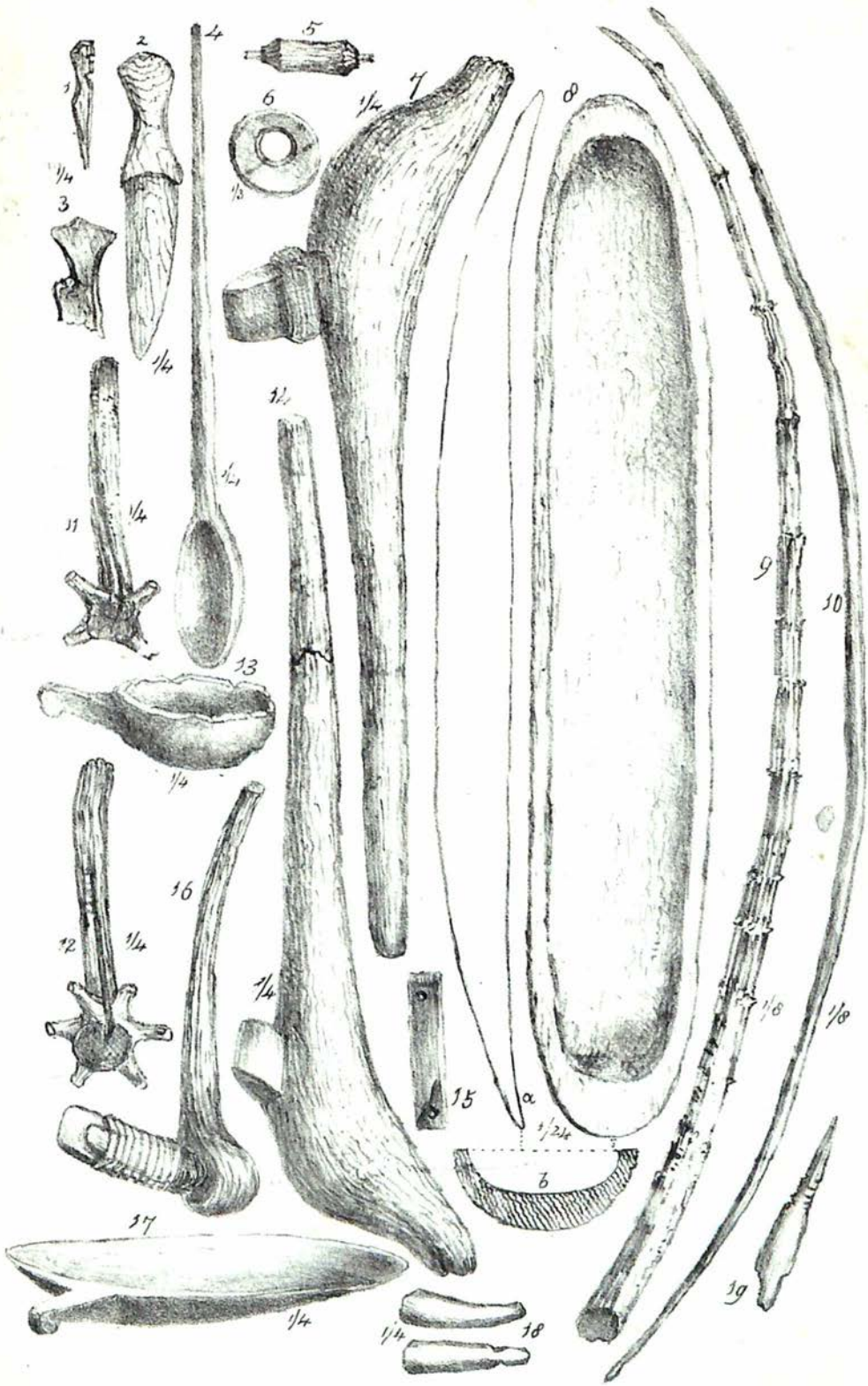
as seen 20 June 1865.

Piles of the last settlement but one—Round Fir Timber.

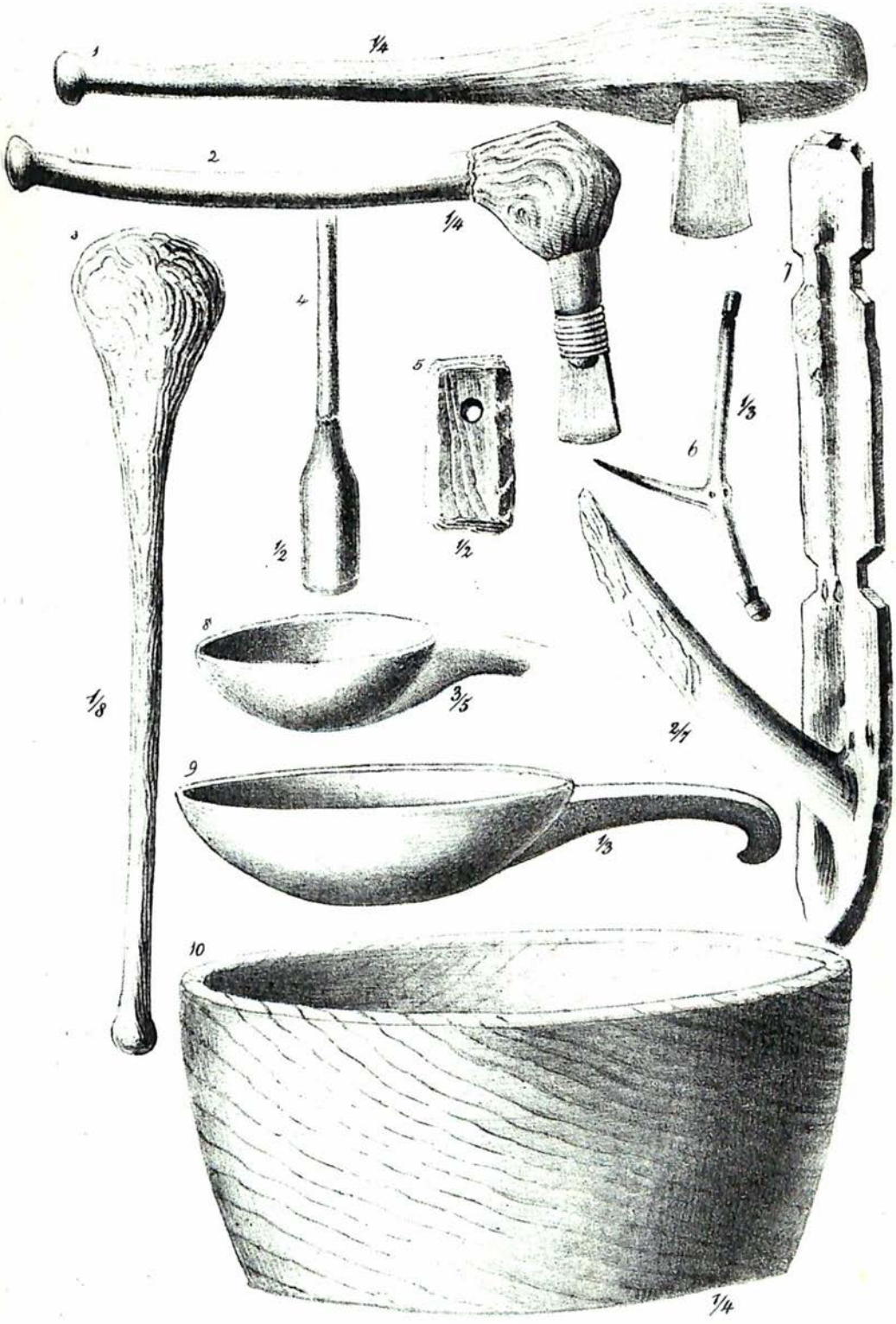


ROBENHAUSEN.

Piles of the latest Settlement — Split Oak stems. as seen 20 June 1865.



ROBENHAUSEN. *Wood &c.*



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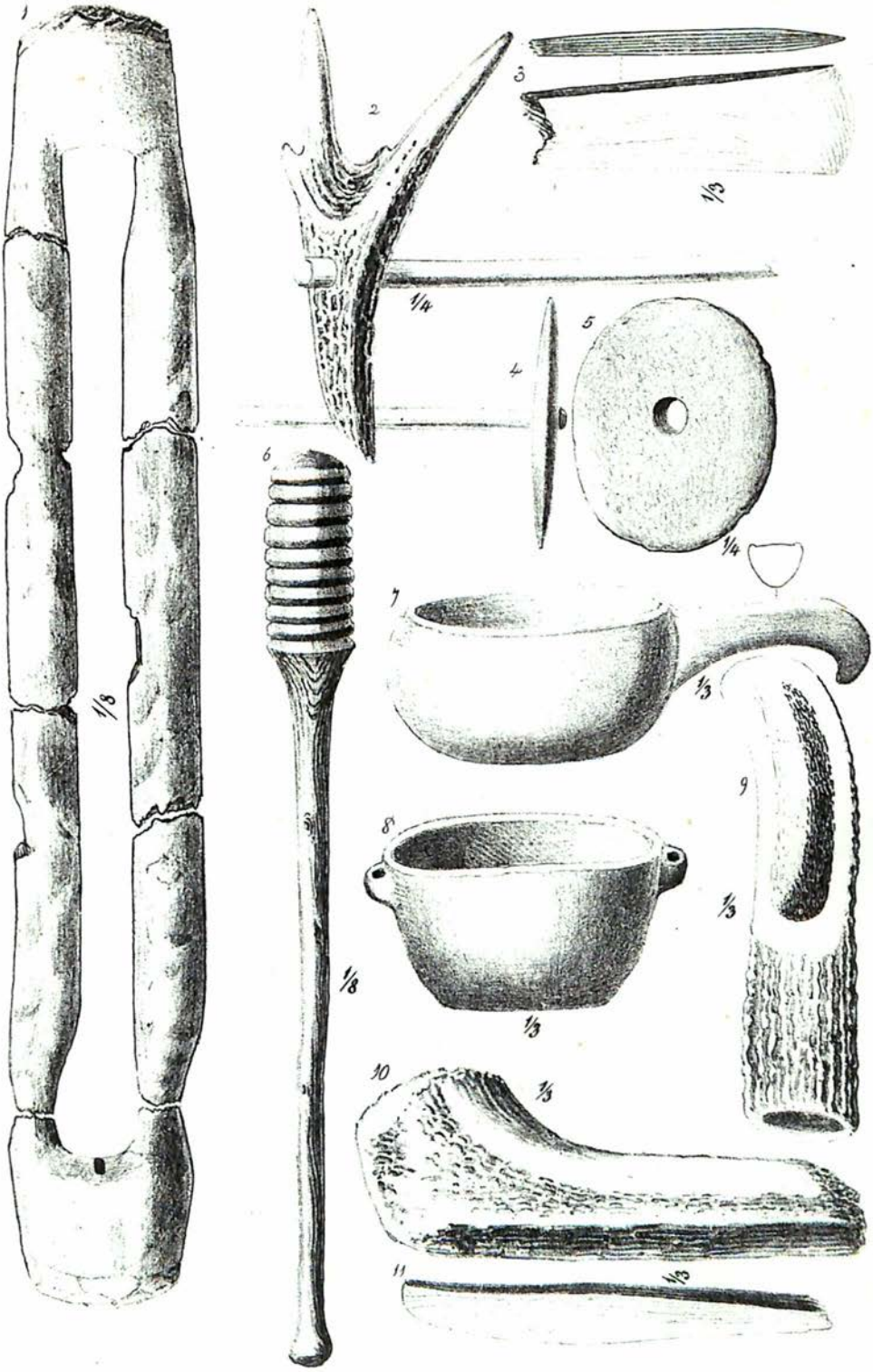
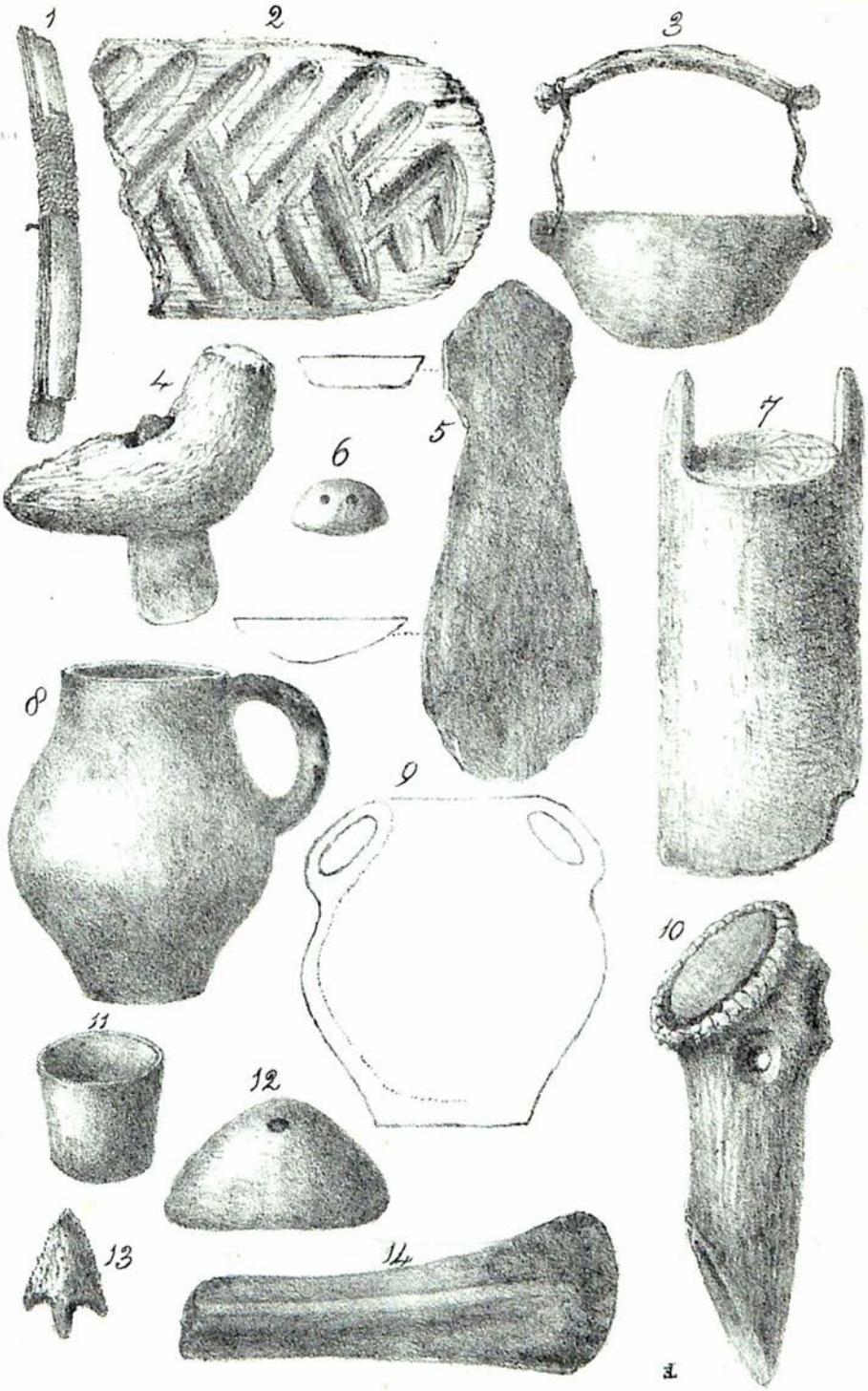


ROBENHAUSEN &c.



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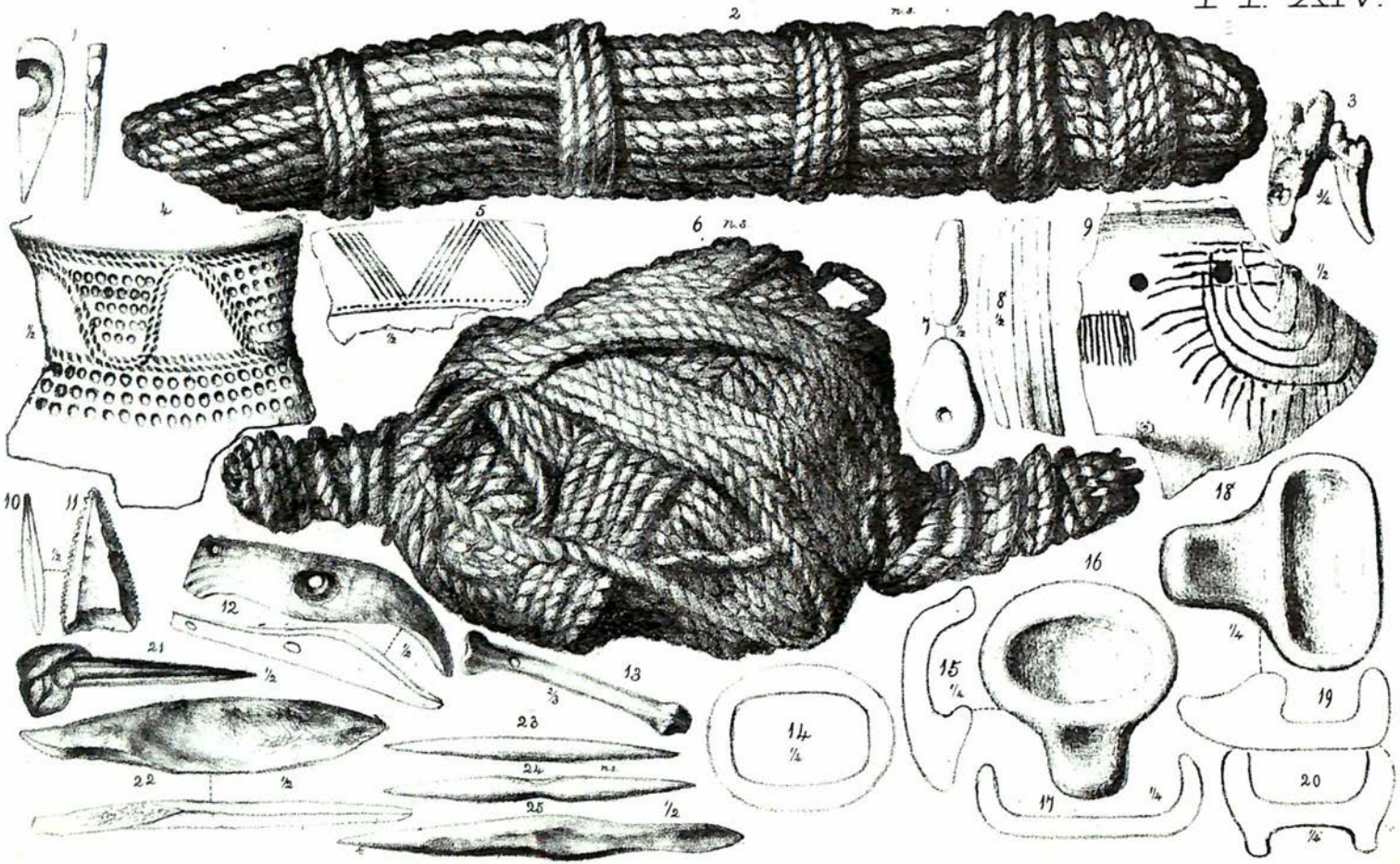
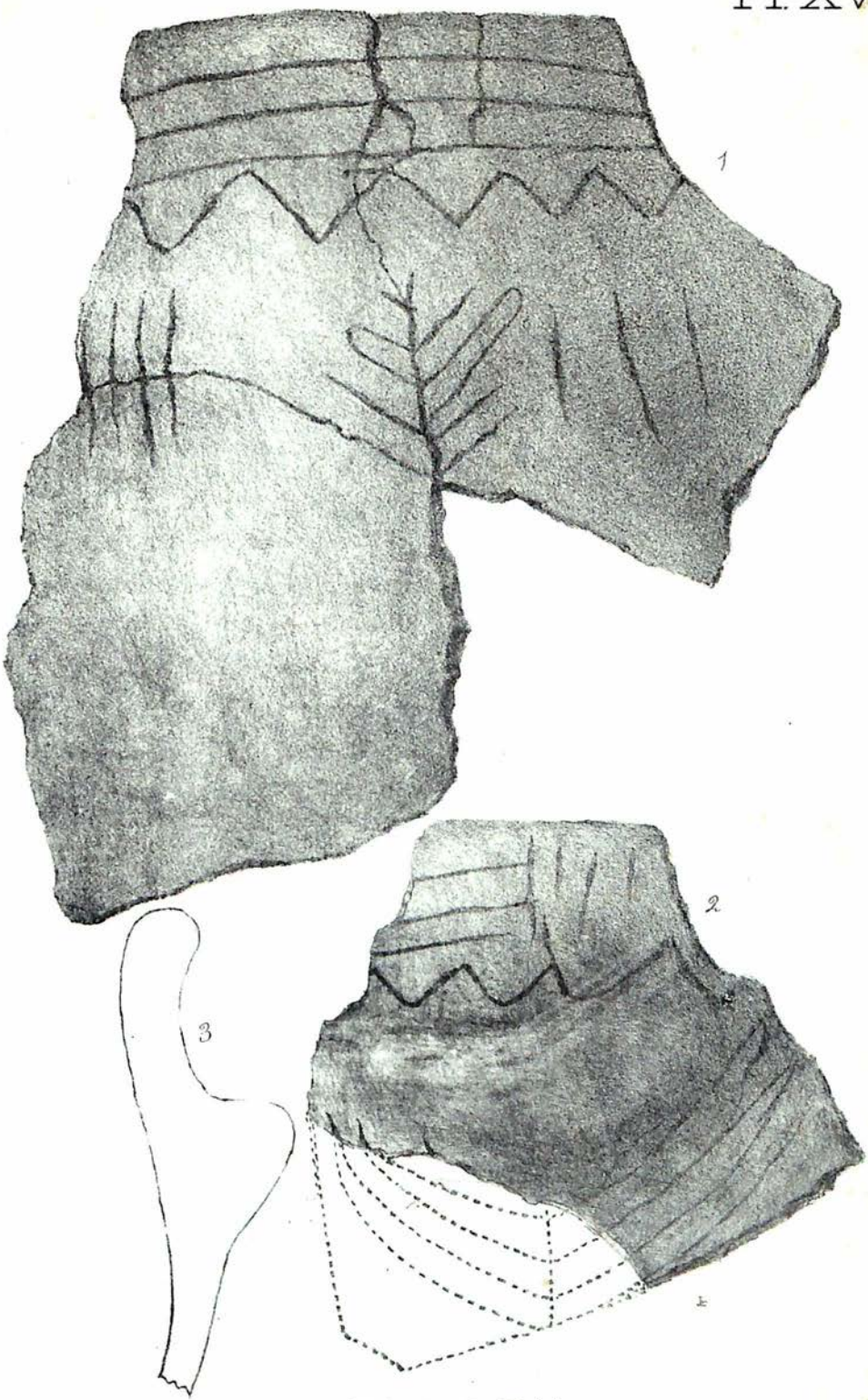


ROBENHAUSEN WANGEN & MOOSSEEDORF.



WANGEN.

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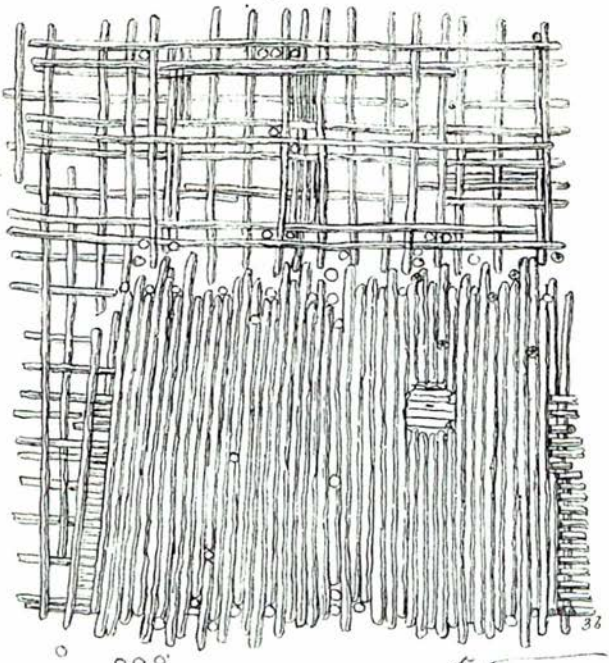
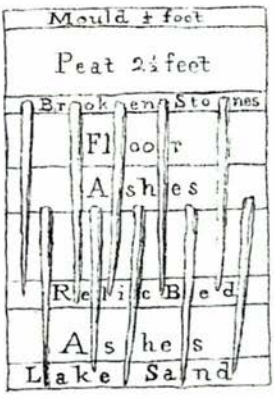


2



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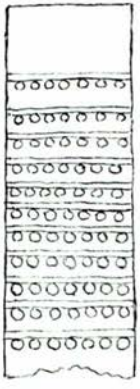

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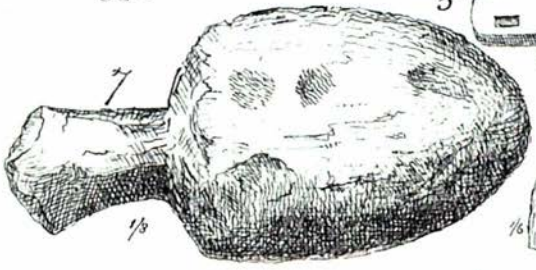

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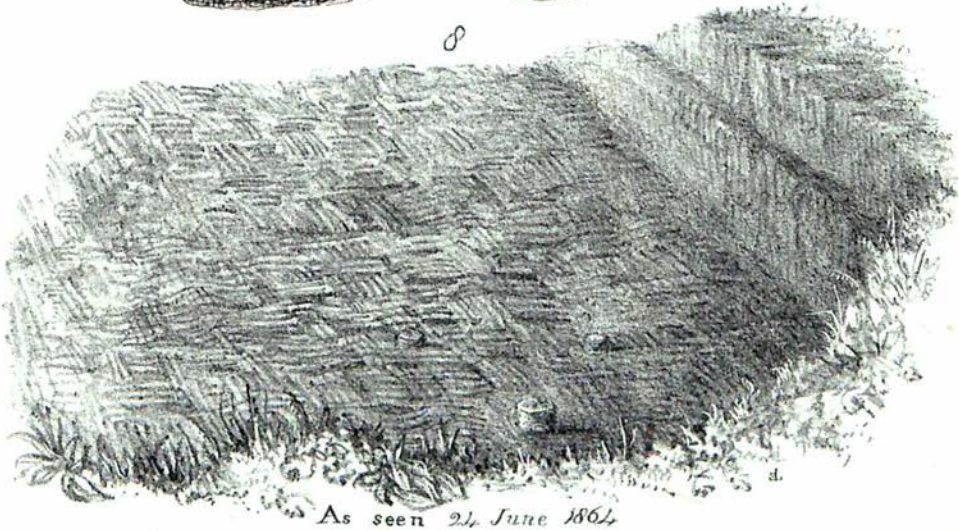
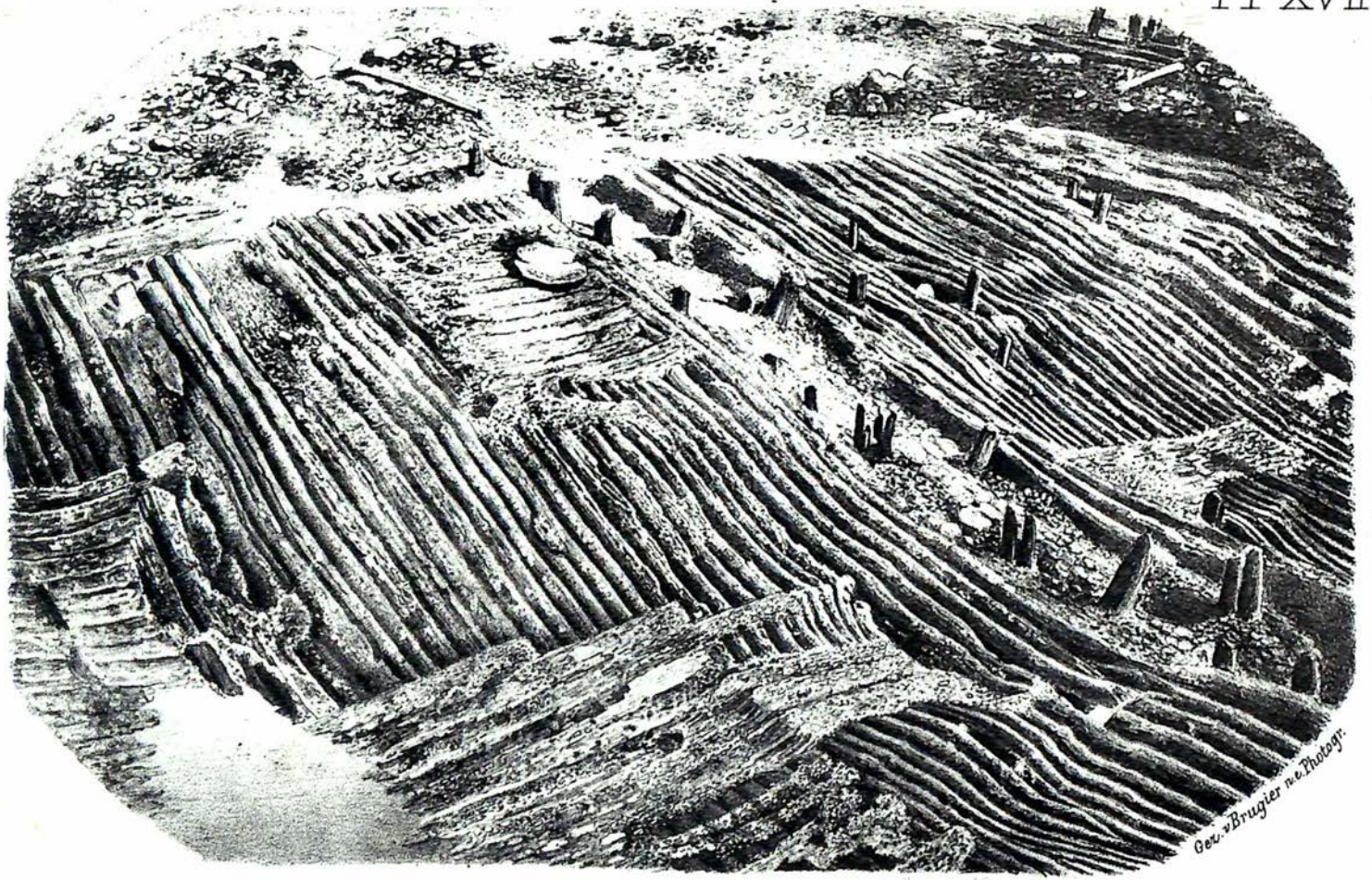
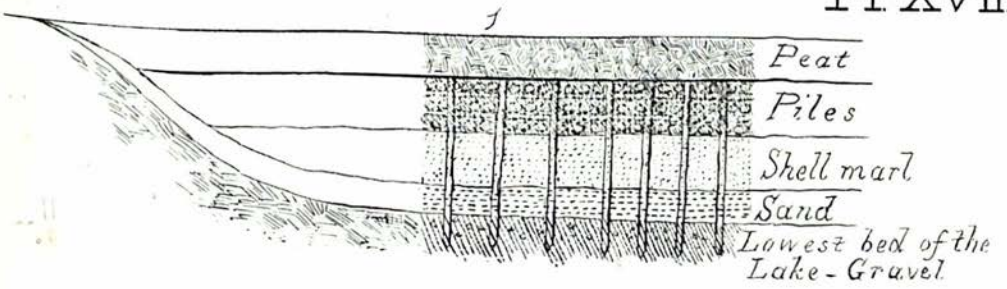


As seen 24 June 1864

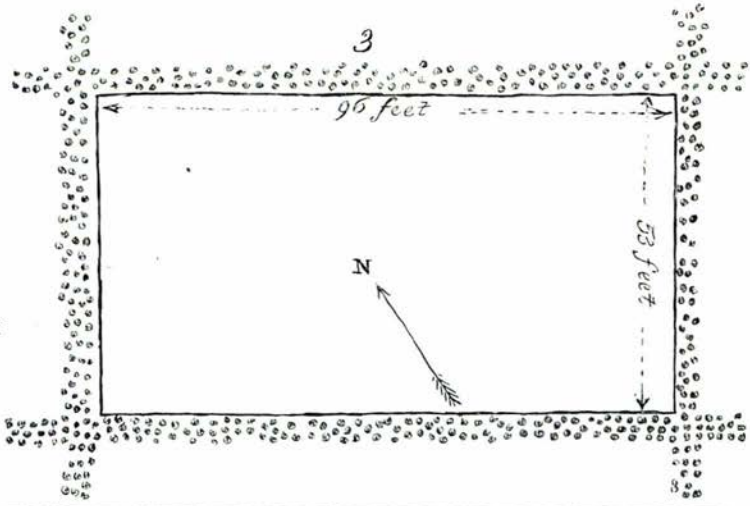
NIEDERWYL, &c.

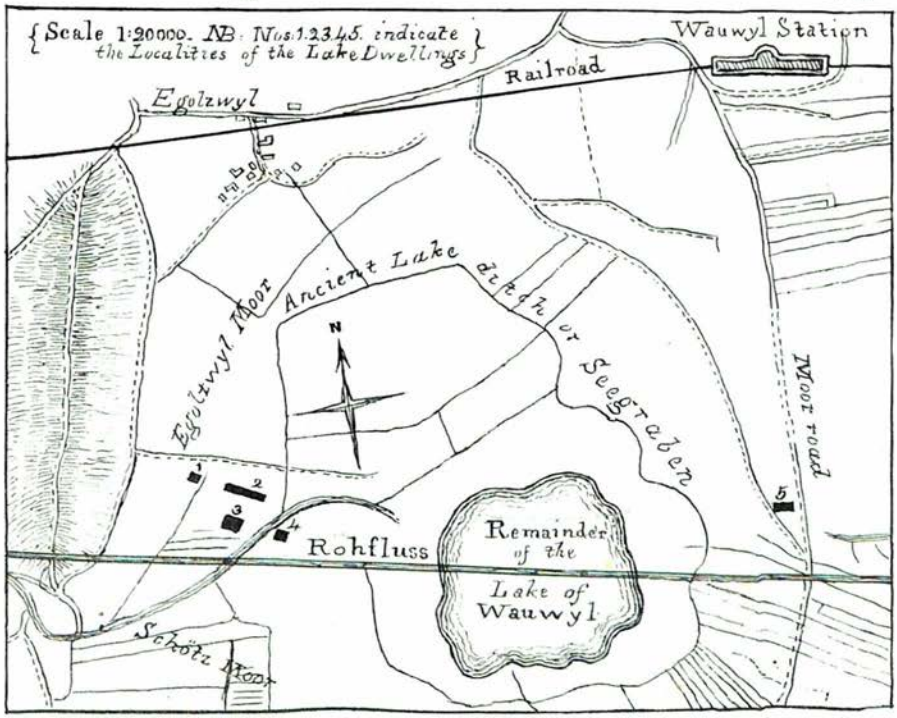


NIEDERWYL.


1
Peat
Piles
Shell marl
Sand
Lowest bed of the Lake-Gravel

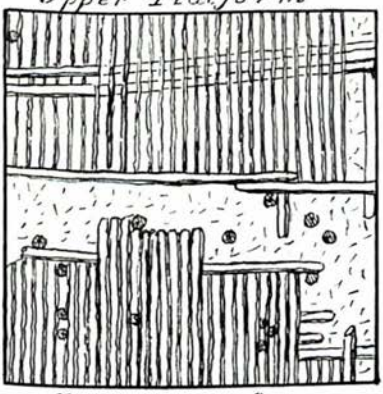
2
Bed of the Lake
Peat


3
96 feet
53 feet
N

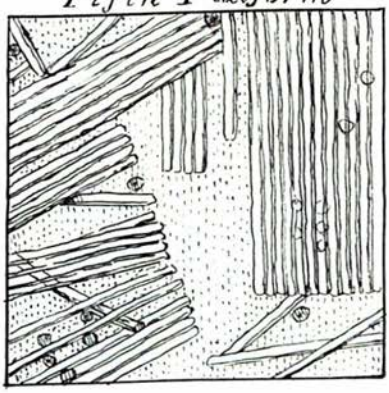

{Scale 1:20000. NB: Nos. 1.2.3.4.5. indicate the Localities of the Lake Dwellings}
Wauwyl Station
Railroad
Egolzwyl
Egolzwyl Moor
Ancient Lake
Seegraben
Moor road
N
Rohfluss
Remainder of the Lake of Wauwyl
School House

WAUWYL

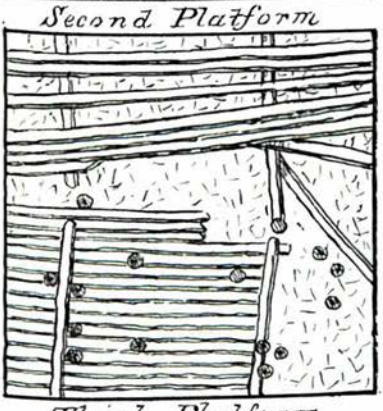
Upper Platform

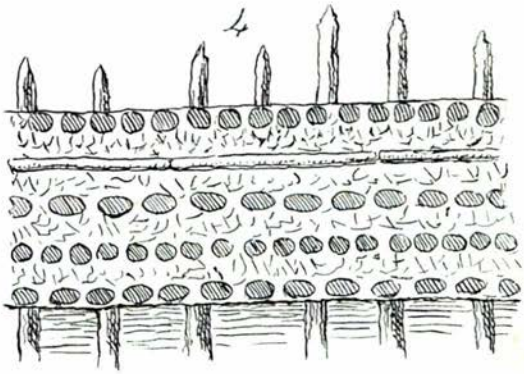


Fifth Platform

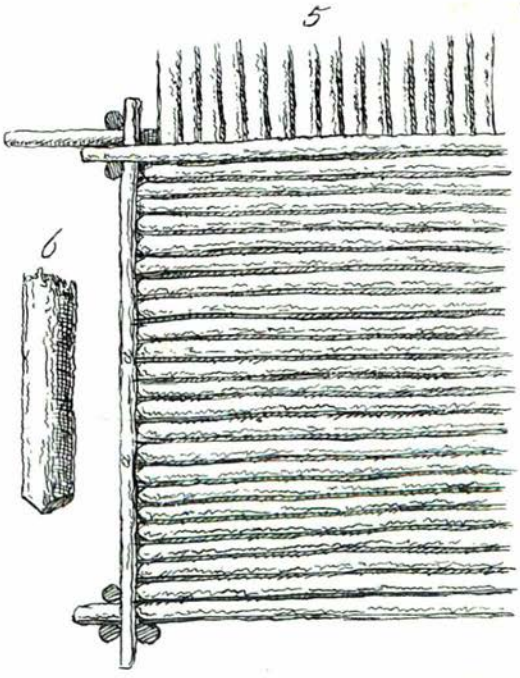


Second Platform

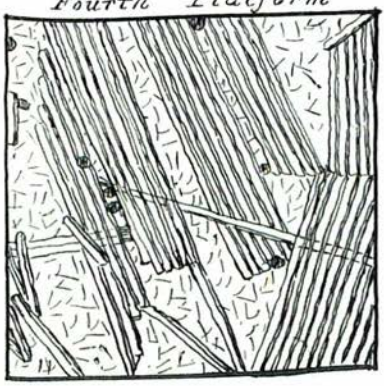




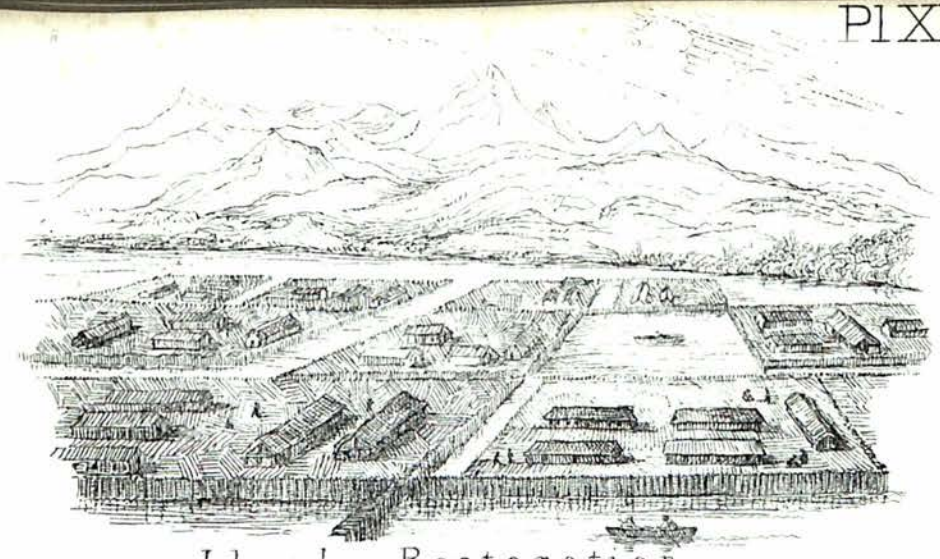
Third Platform



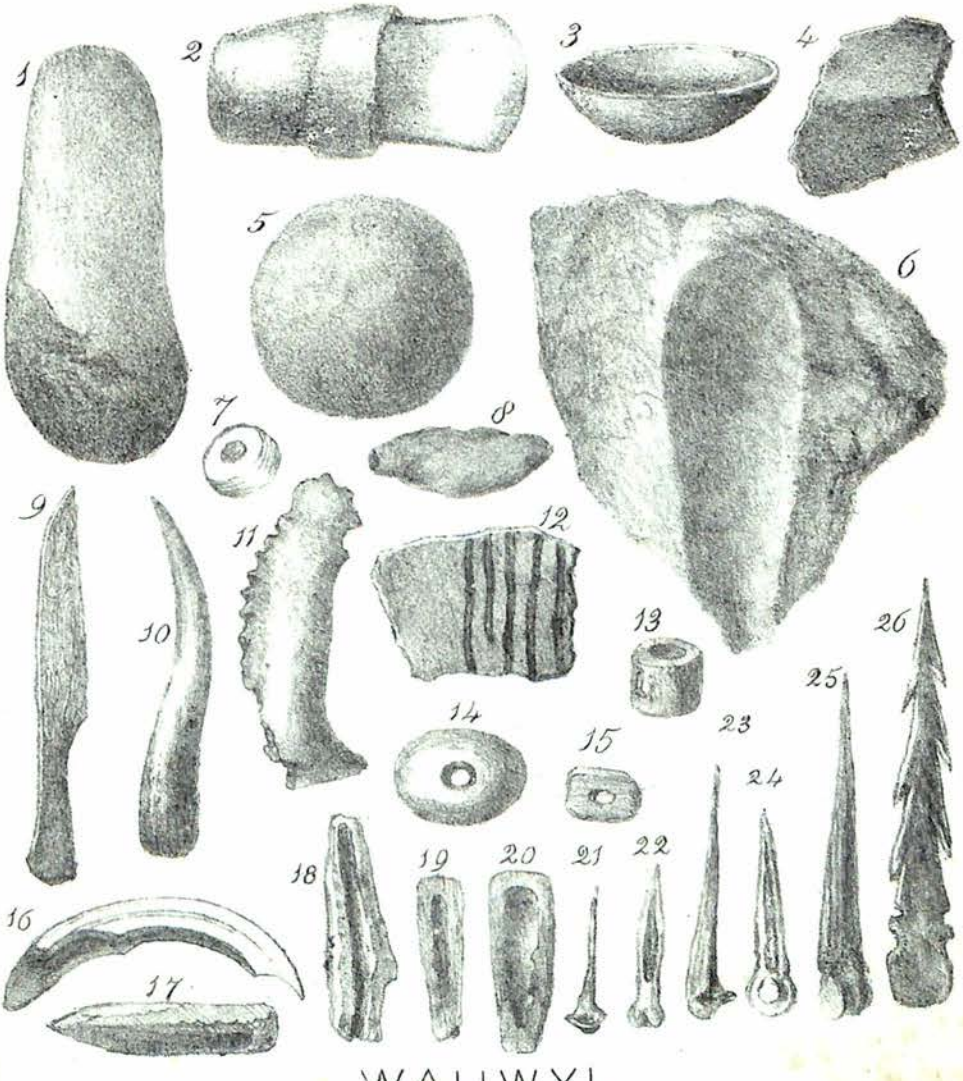
Fourth Platform



WAUWYL.



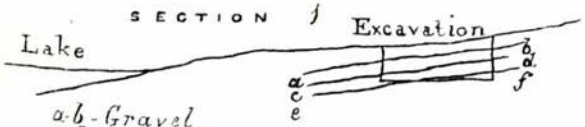
Ideal Restoration



WAUWYL.

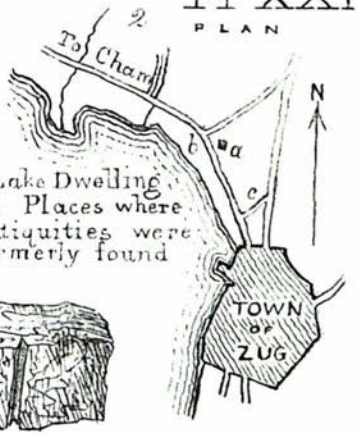
Fig. 7 Nat. Size Remainder ⅛

SECTION 1

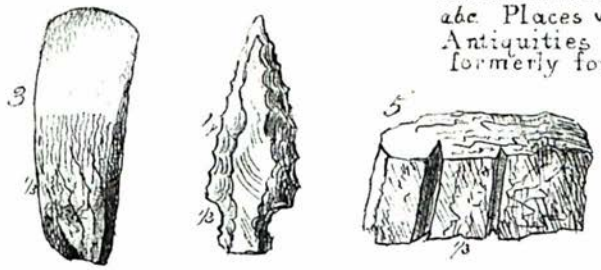


a-b - Gravel
c-d Relic Bed
e-f Shell Marl

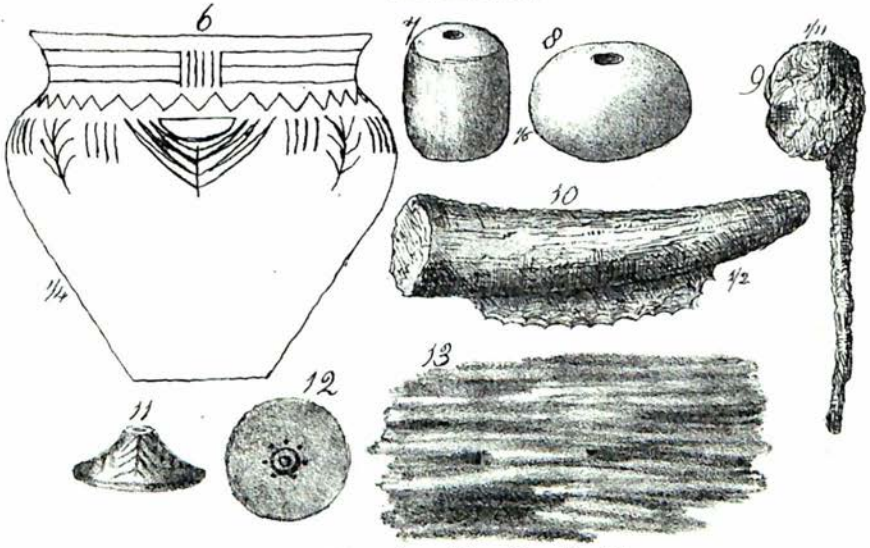
2 PLAN



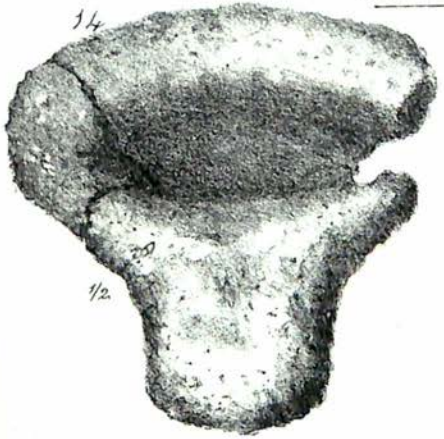
a. Lake Dwelling
abc Places where Antiquities were formerly found



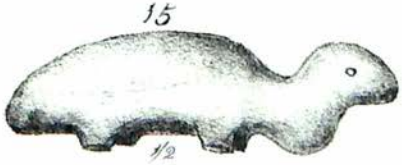
ZUG



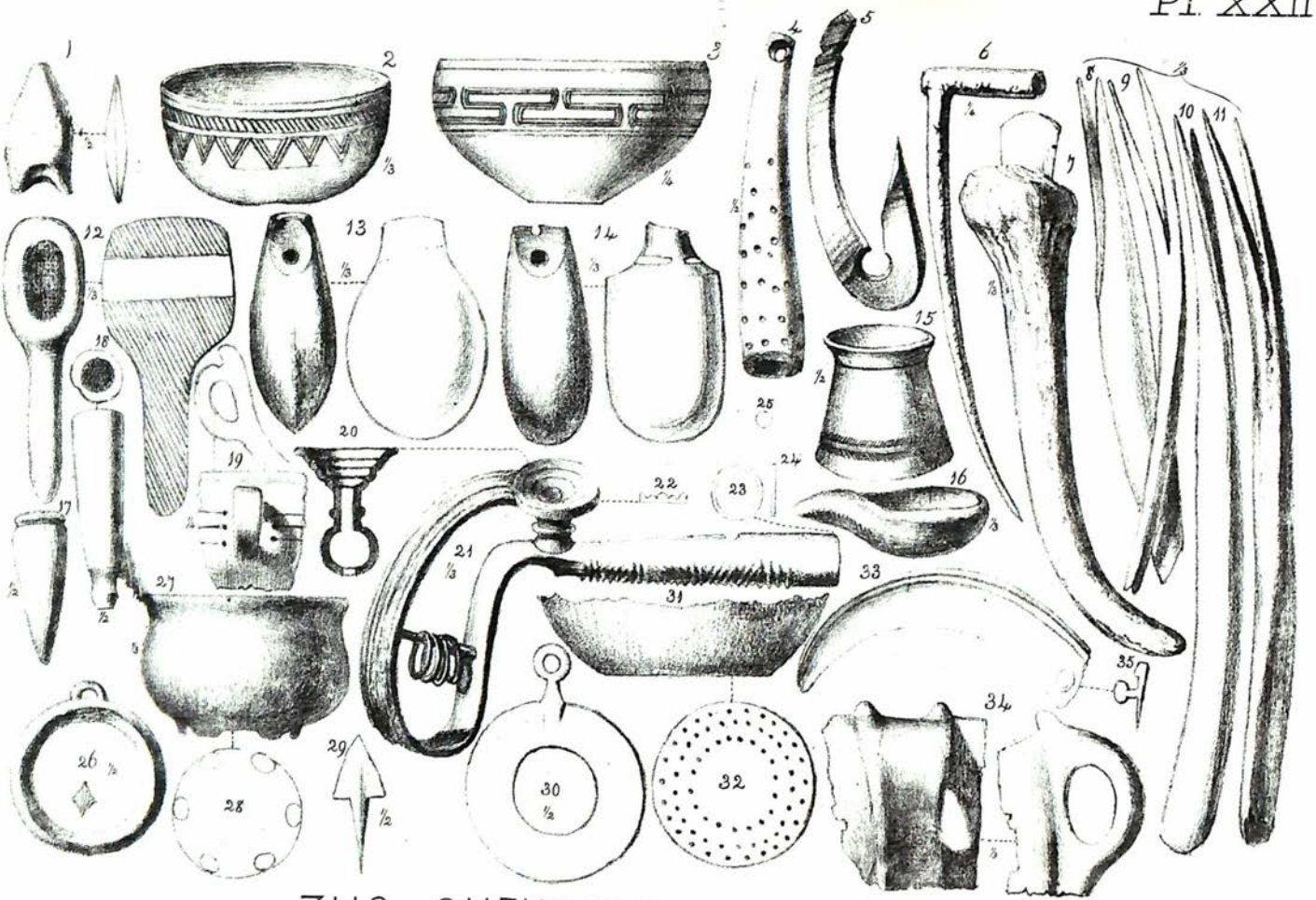
WANGEN



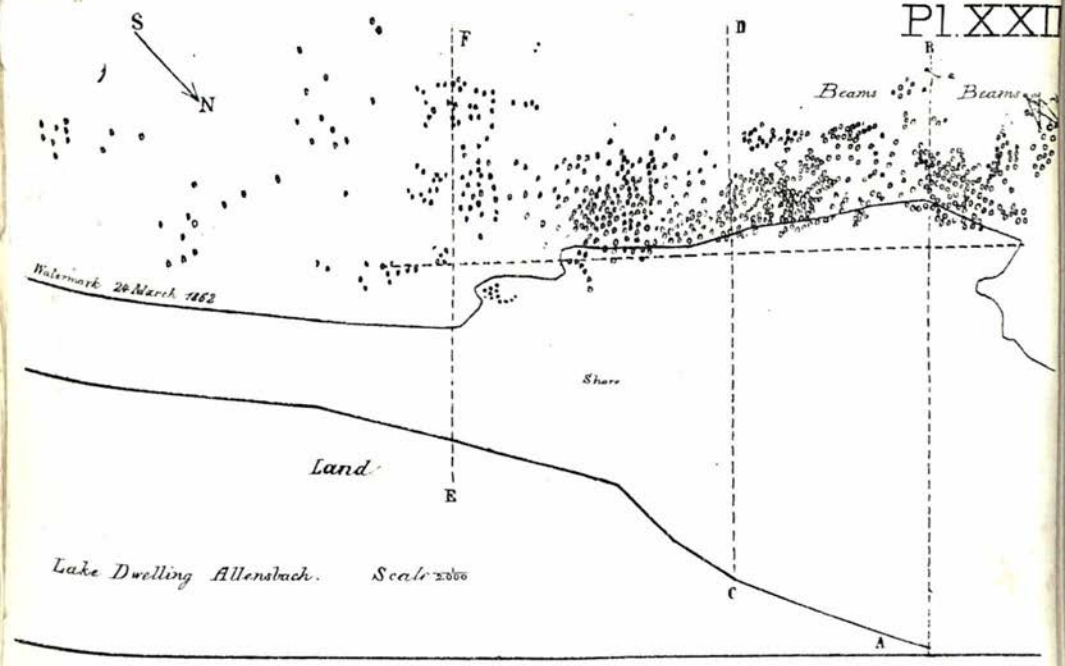
ROBENHAUSEN

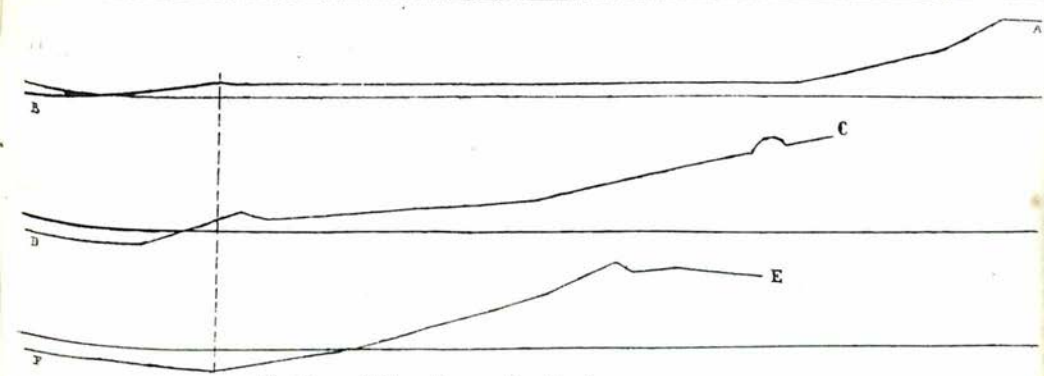


NIDAU

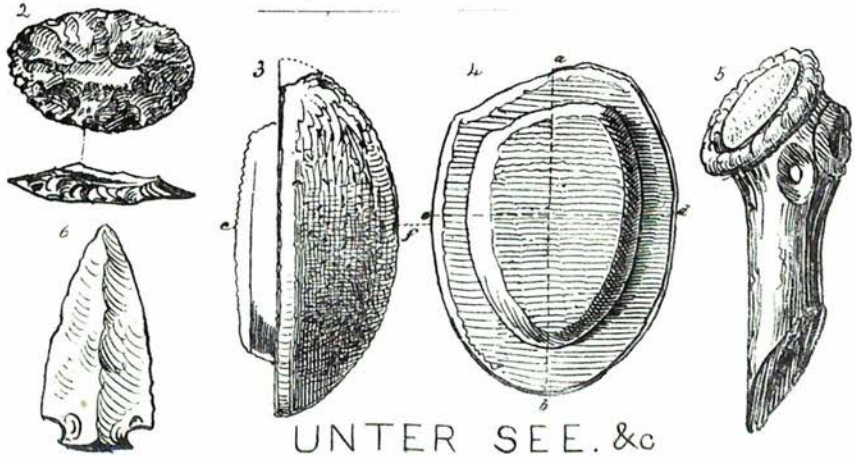


ZUG CHEVROUX WAUWYL &c.

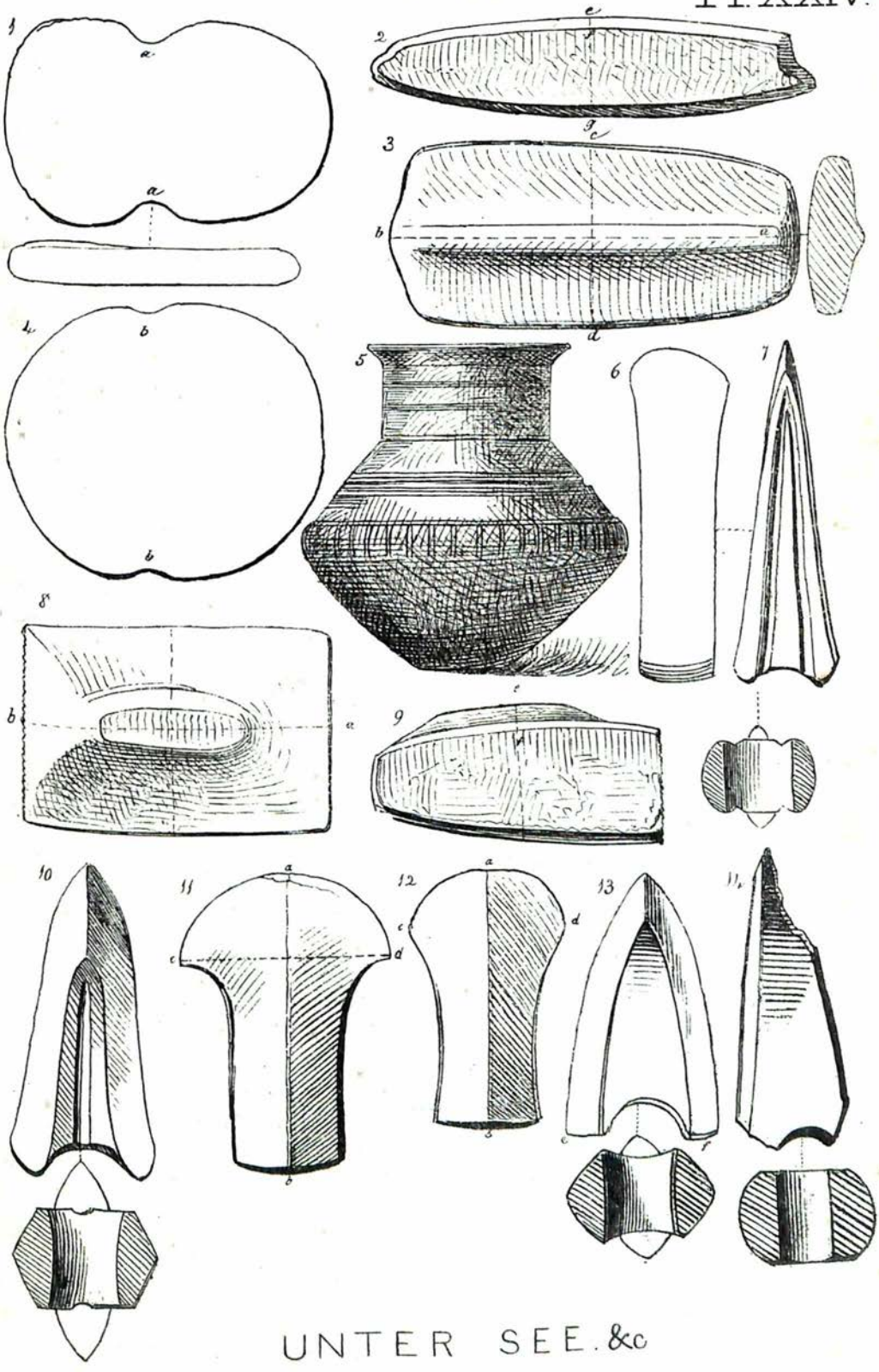




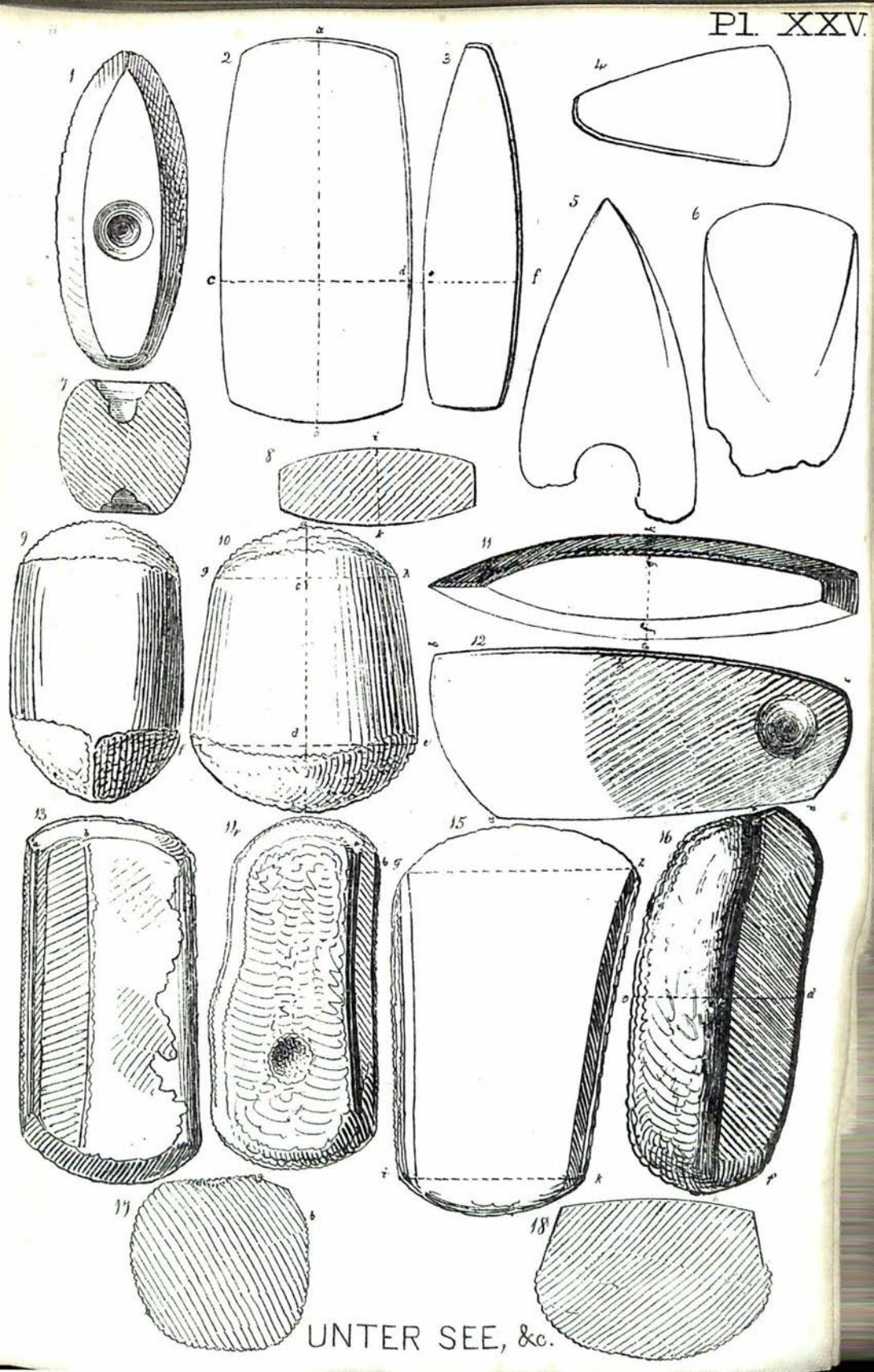
Section of the above, Scale $\frac{1}{1000}$



UNTER SEE. &c

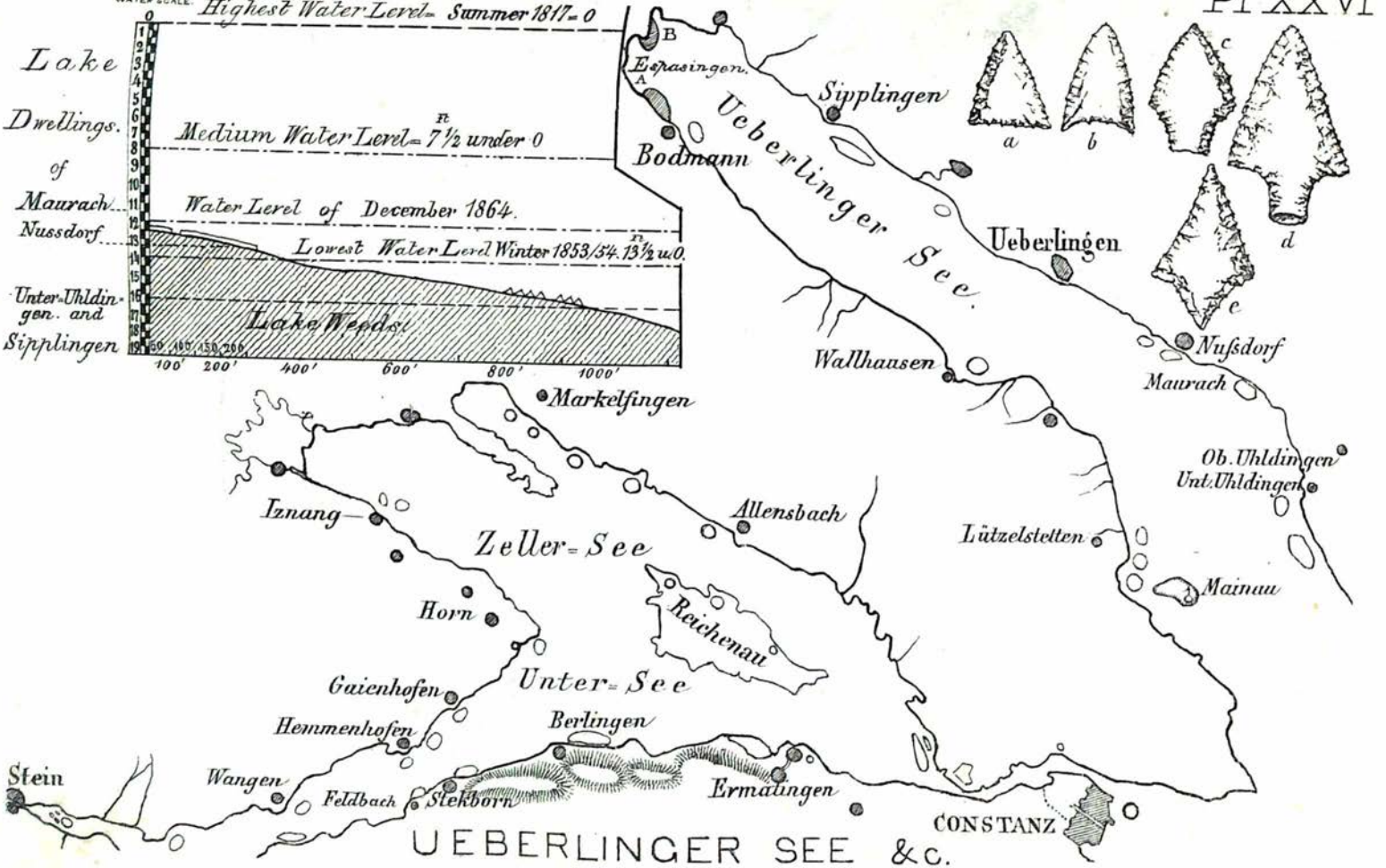


UNTER SEE. &c



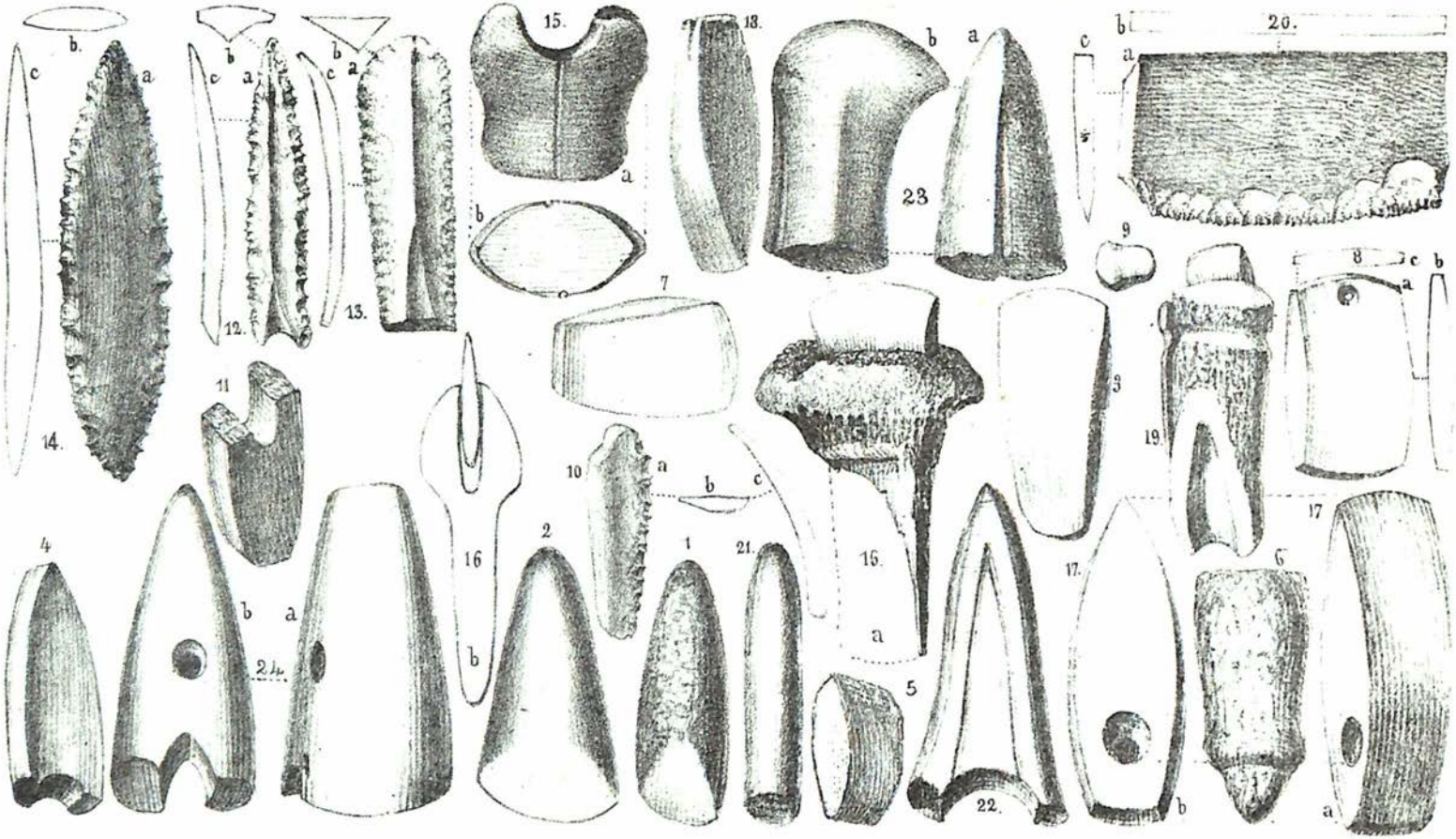
UNTER SEE, &c.

WATER SCALE.
Highest Water Level = Summer 1817 = 0
Lake Dwellings of Maurach Nussdorf
Medium Water Level = 7½ under 0
Water Level of December 1864.
Lowest Water Level Winter 1853/54. 13½ u/0.
Unter-Uhldingen and Sipplingen
Lake Weeds.
100' 200' 400' 600' 800' 1000'



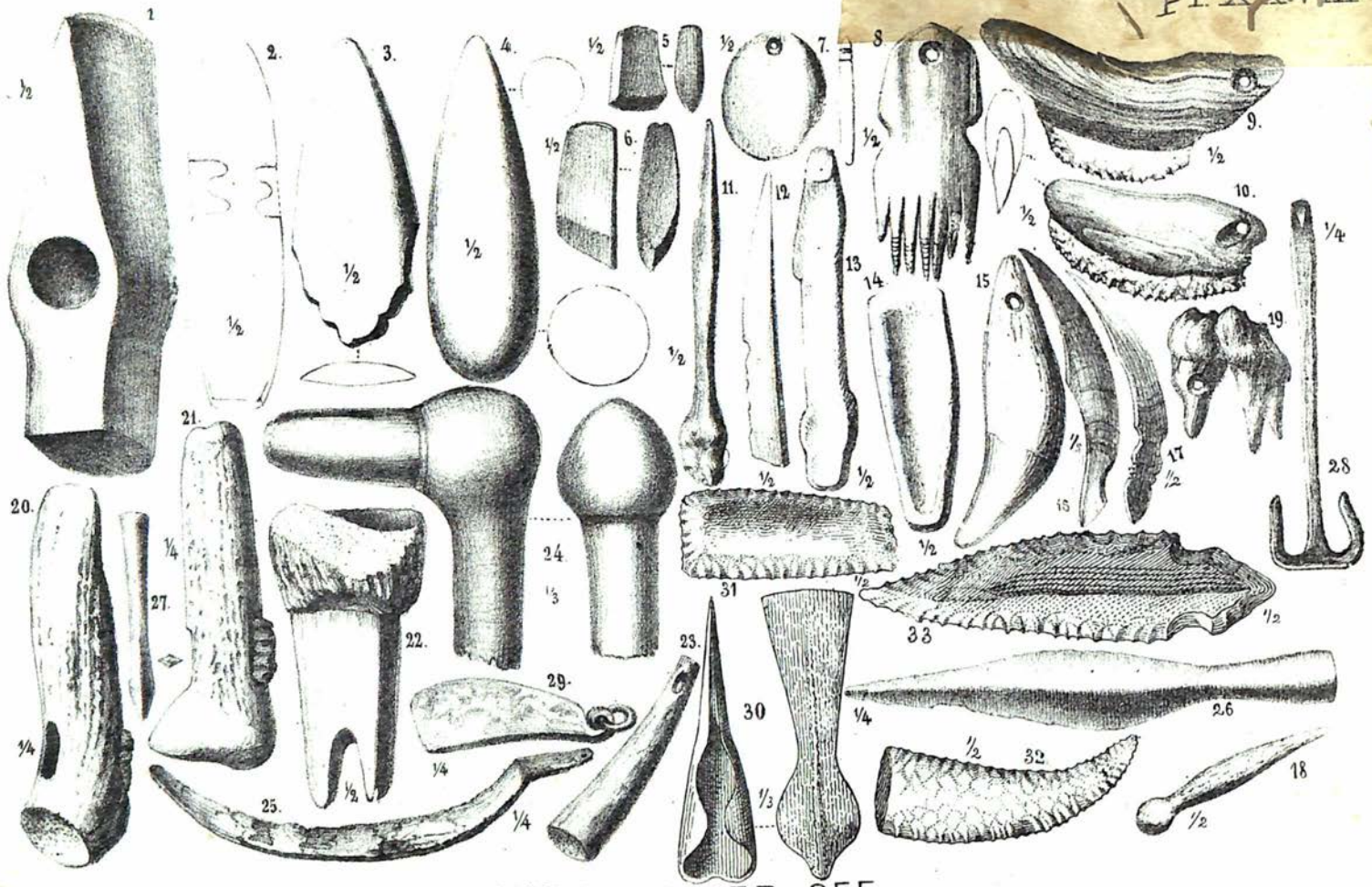
UEBERLINGER SEE &c.

Pl XXVII

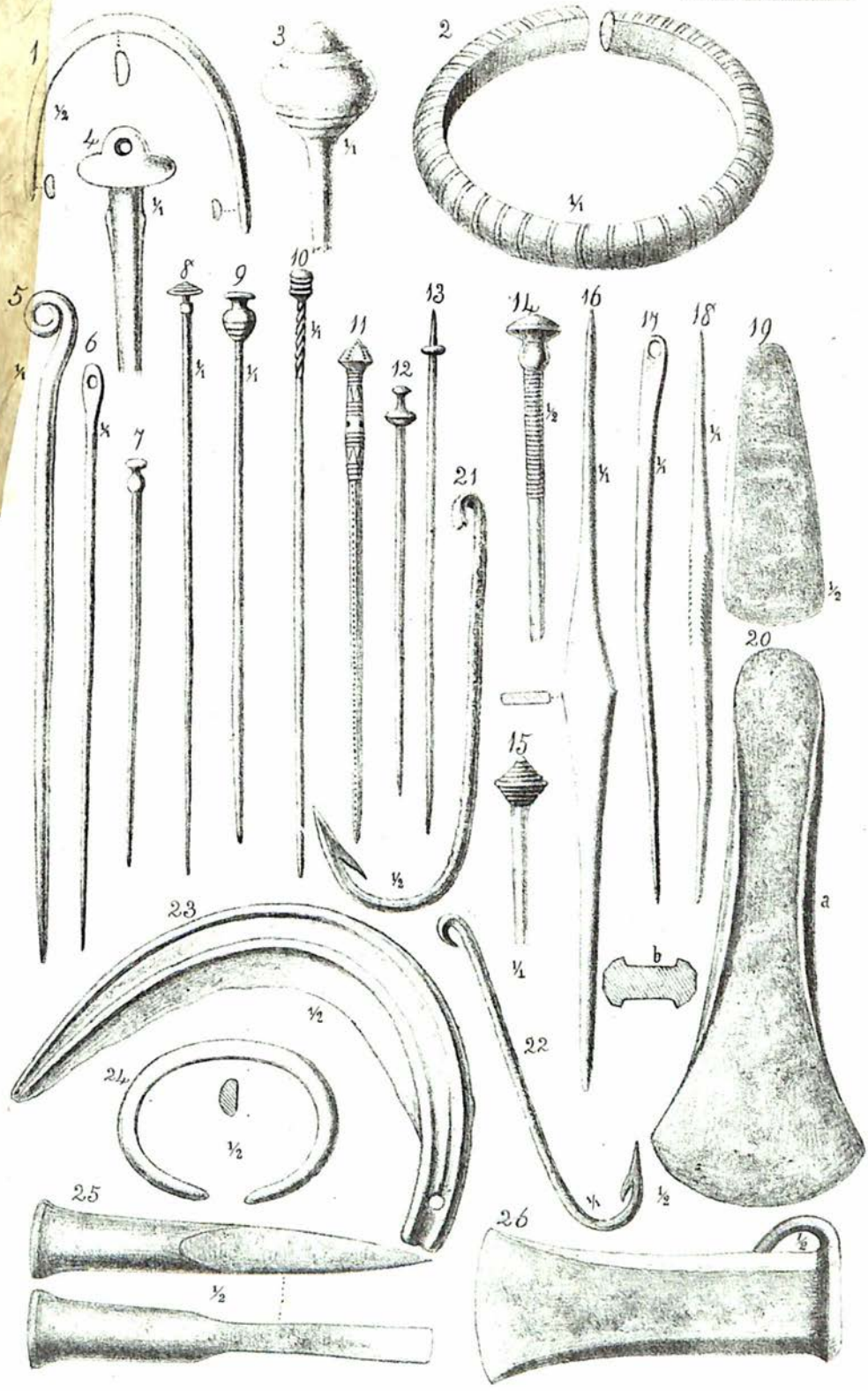


UEBERLINGER SEE.

½ Full Size.



UEBERLINGER SEE.



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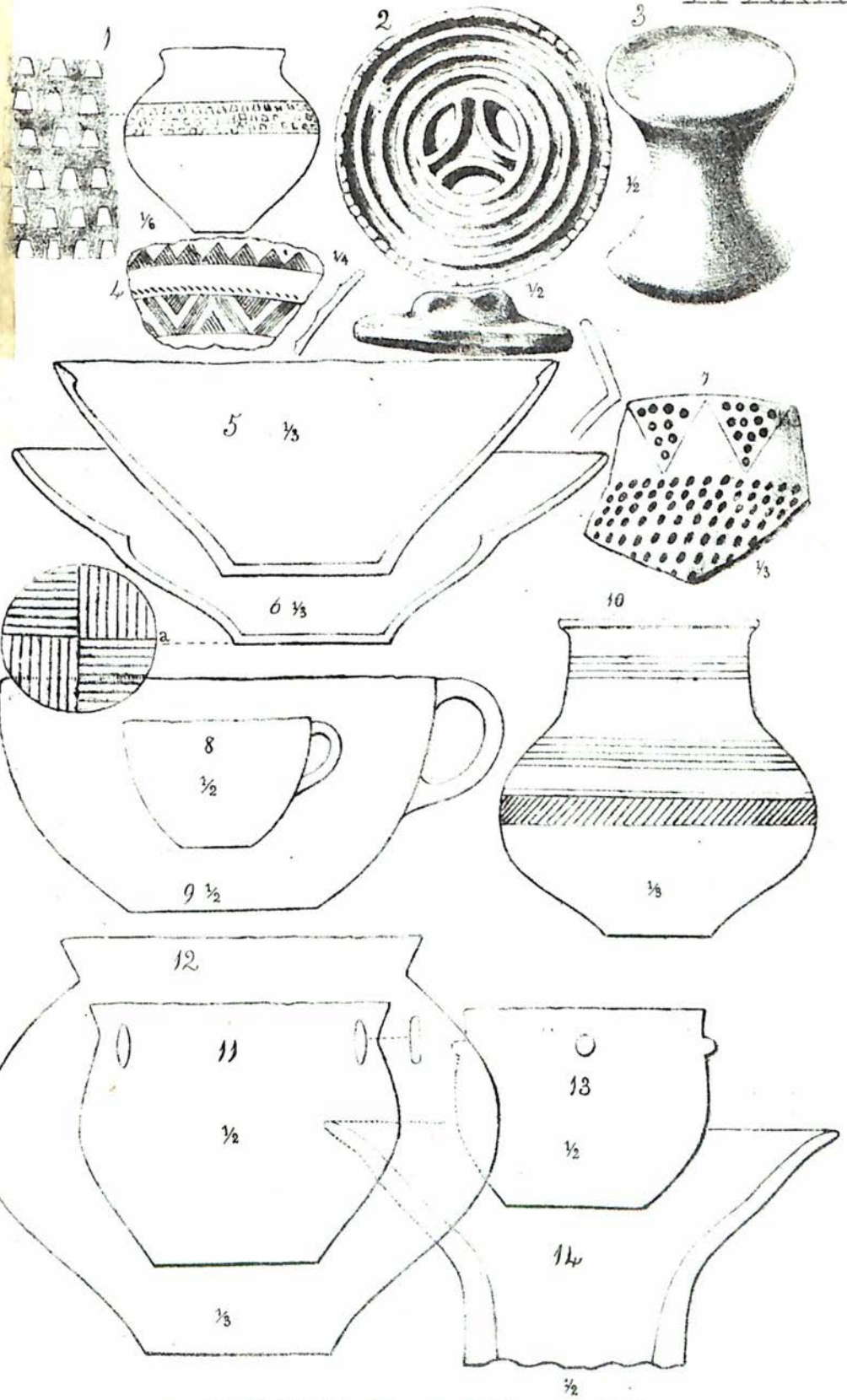

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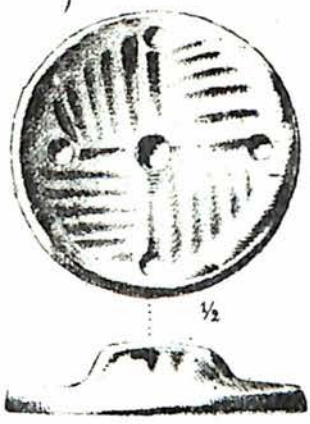

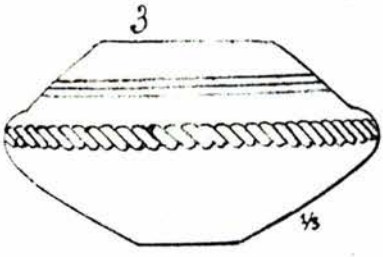

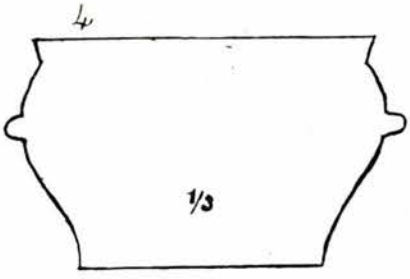

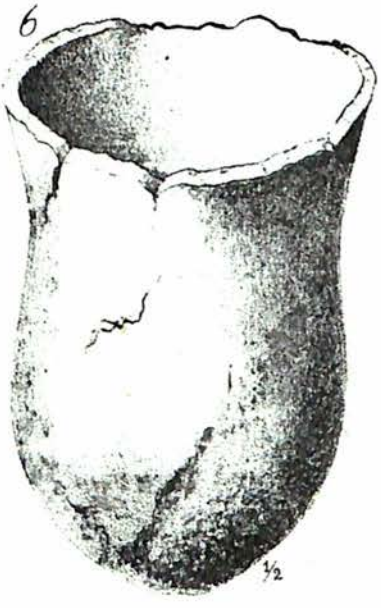

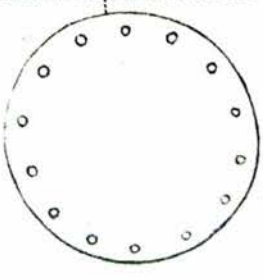

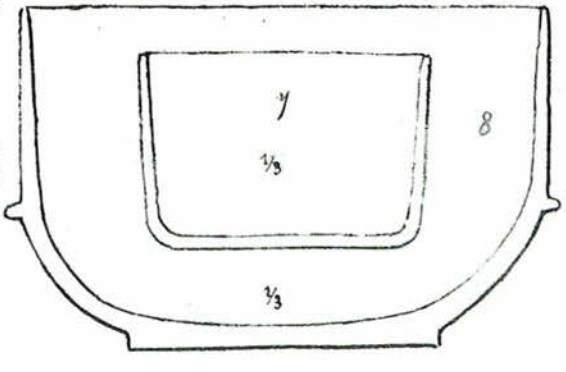

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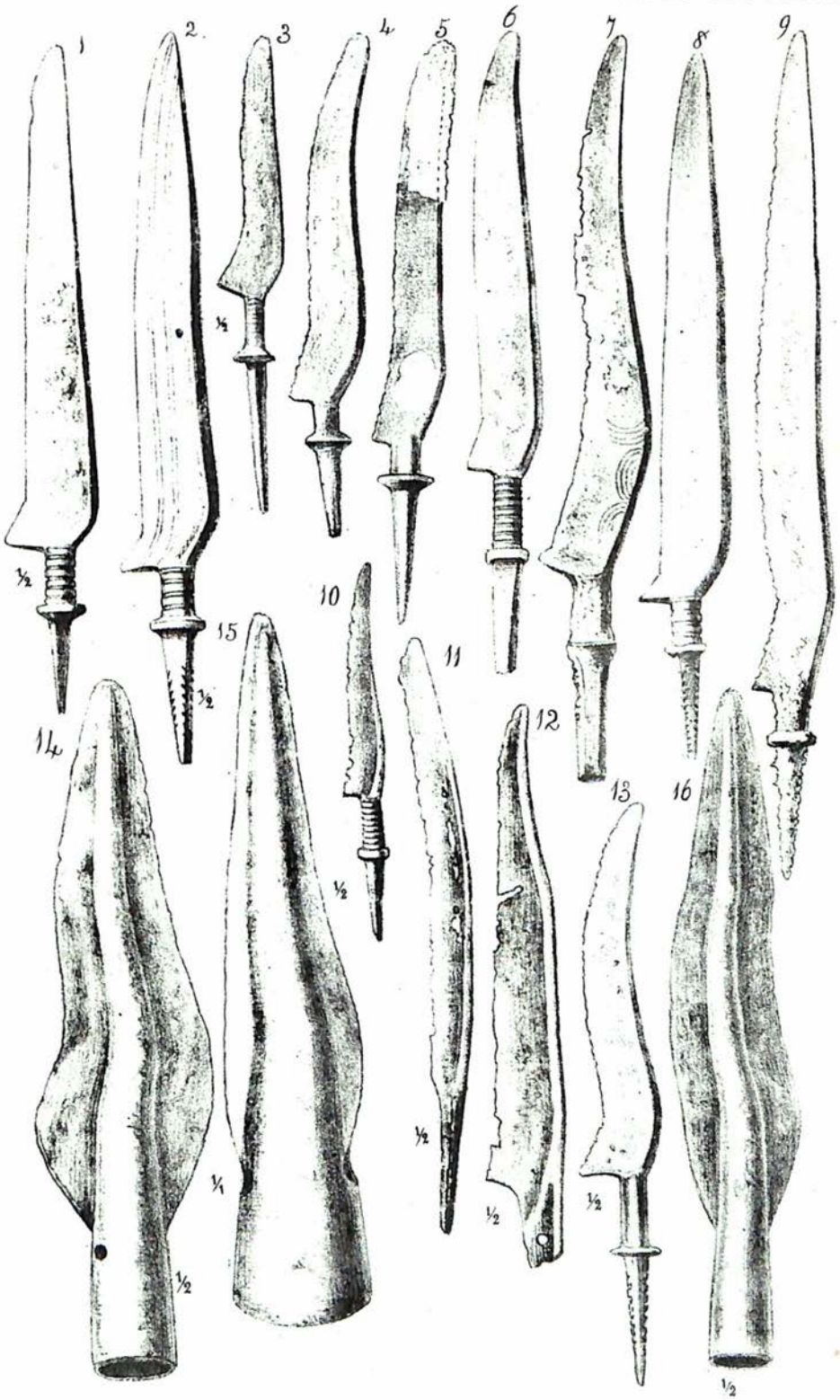

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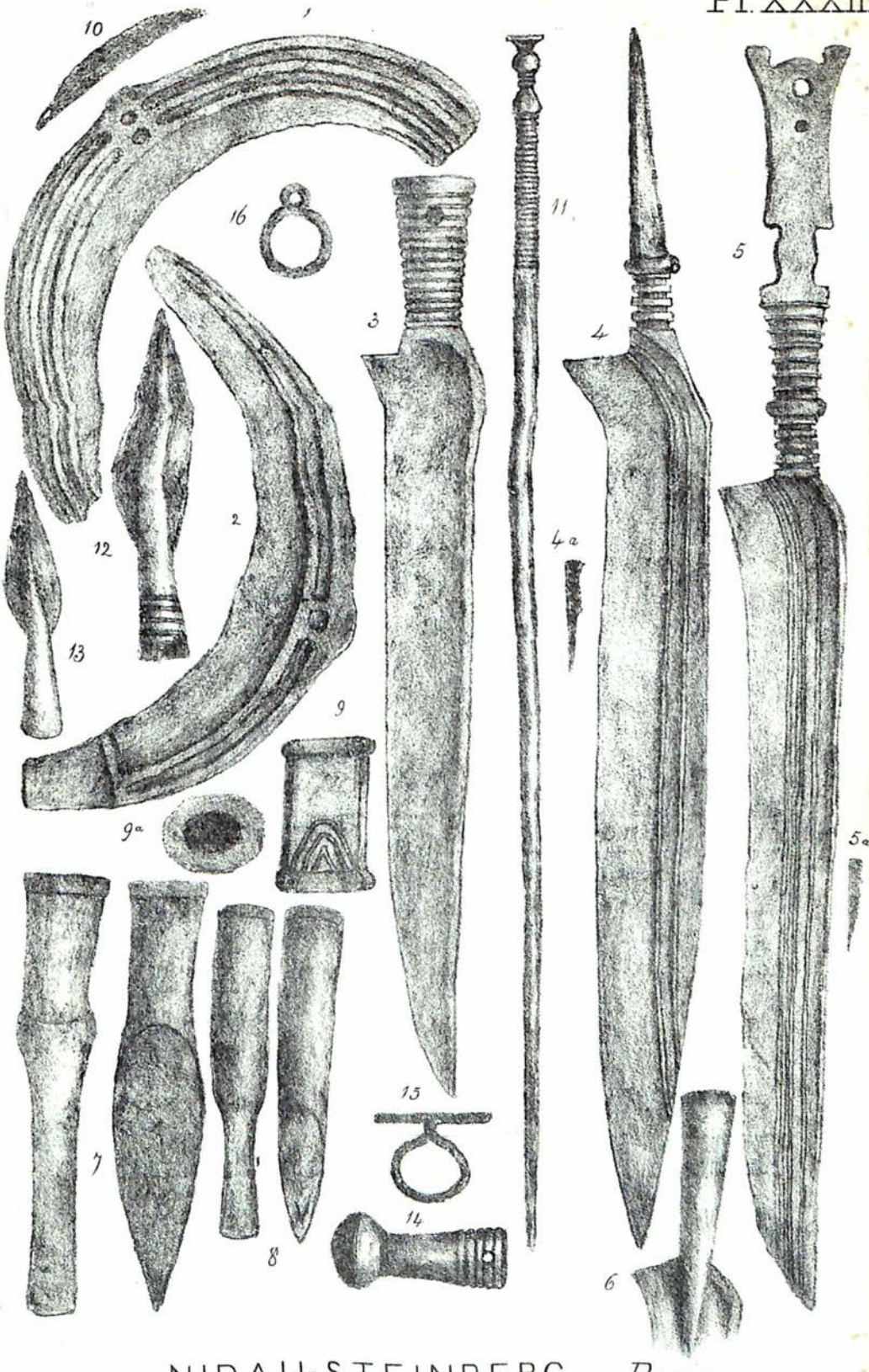
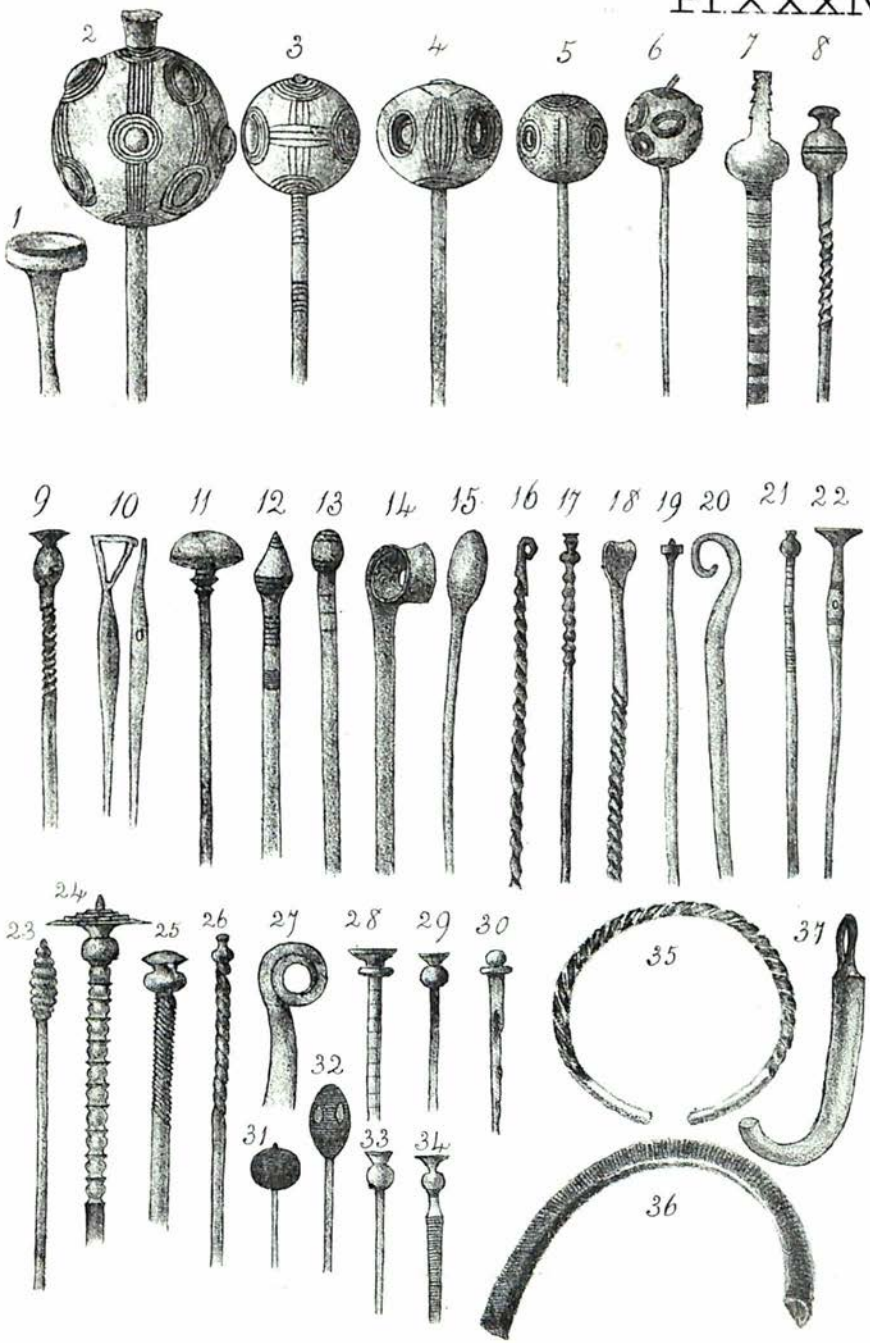
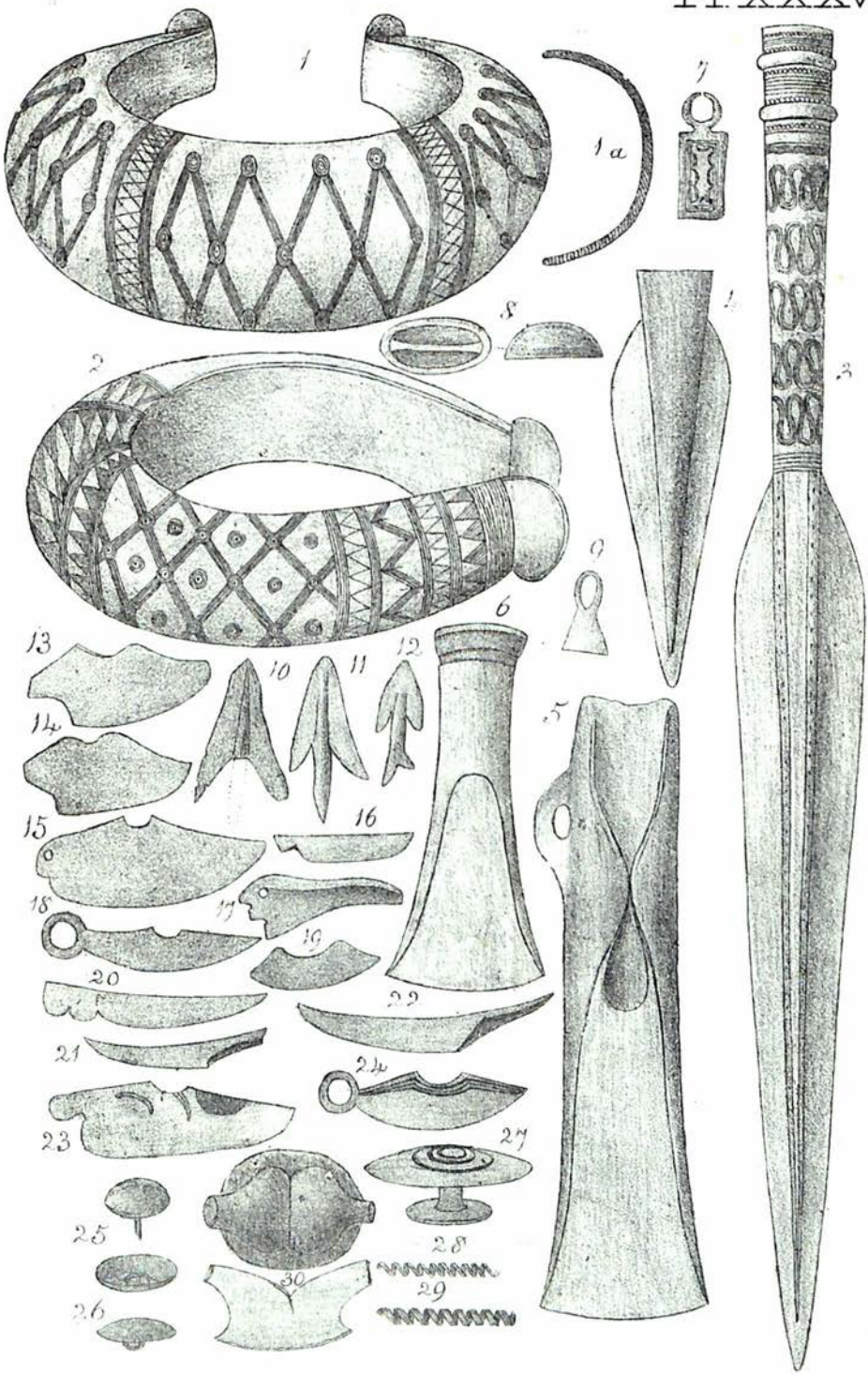


NIDAU-STEINBERG *Bronze.*



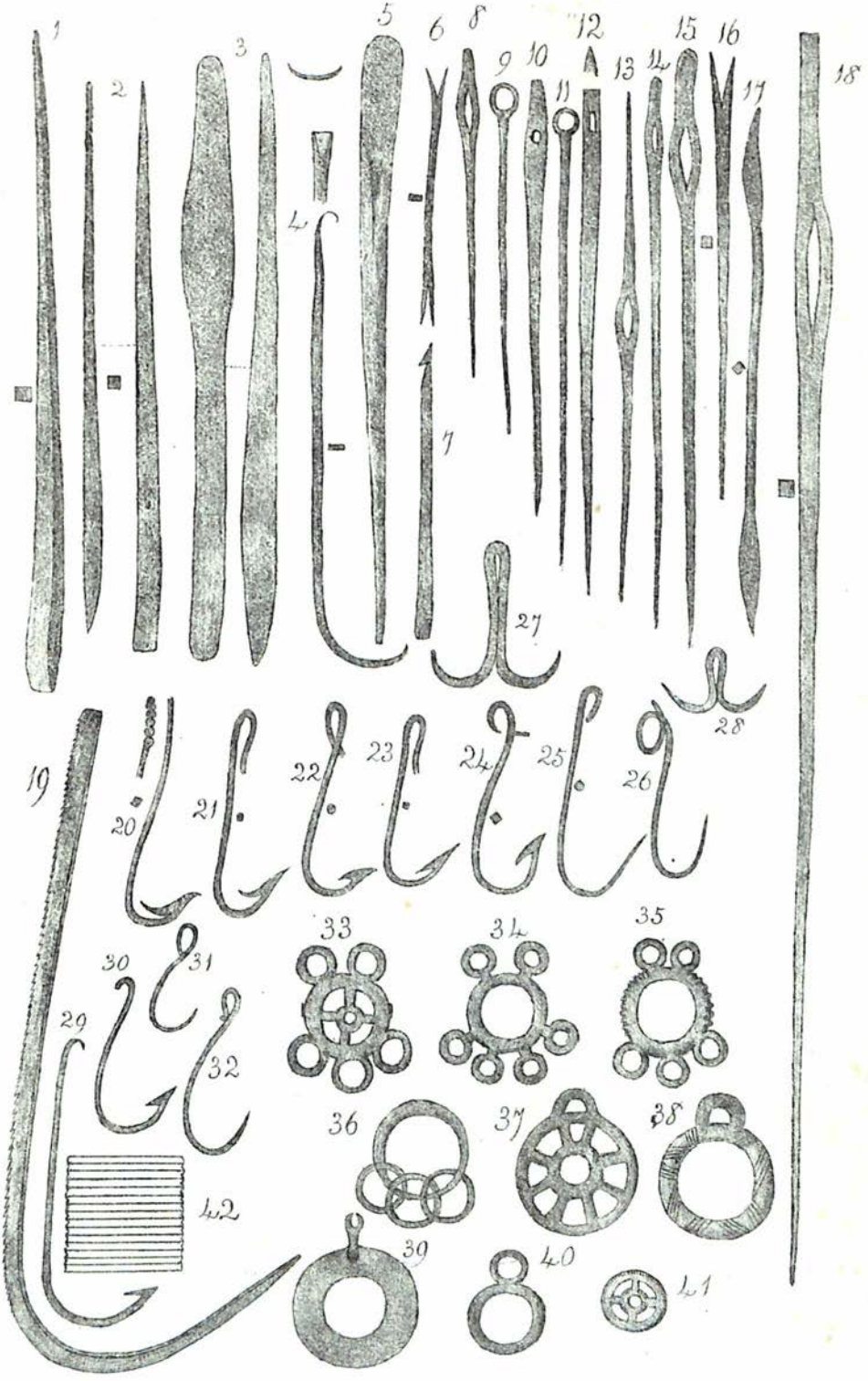
NIDAU STEINBERG. *Bronze.*

Figs 1. 4. to 23. 28. to 30. 33 to 37. ½ size. – 2. 3. ⅓ size. 24 to 27. 31 32 full size.



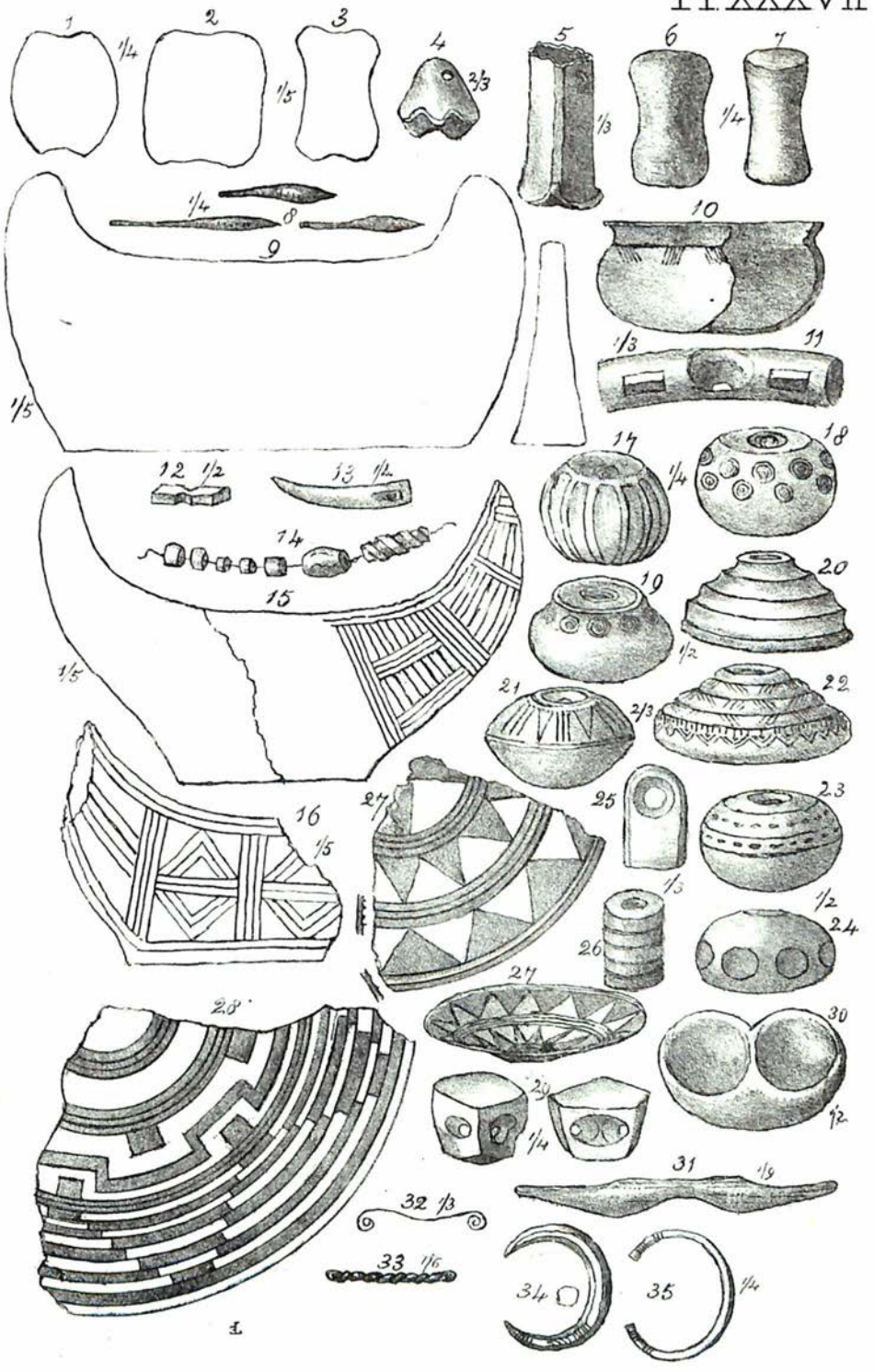
NIDAU-STEINBERG. *Bronze.*

Figs. 10 to 12. 25 to 27. 30. ½ size. 13 to 24. ½ size. Rem. full size.

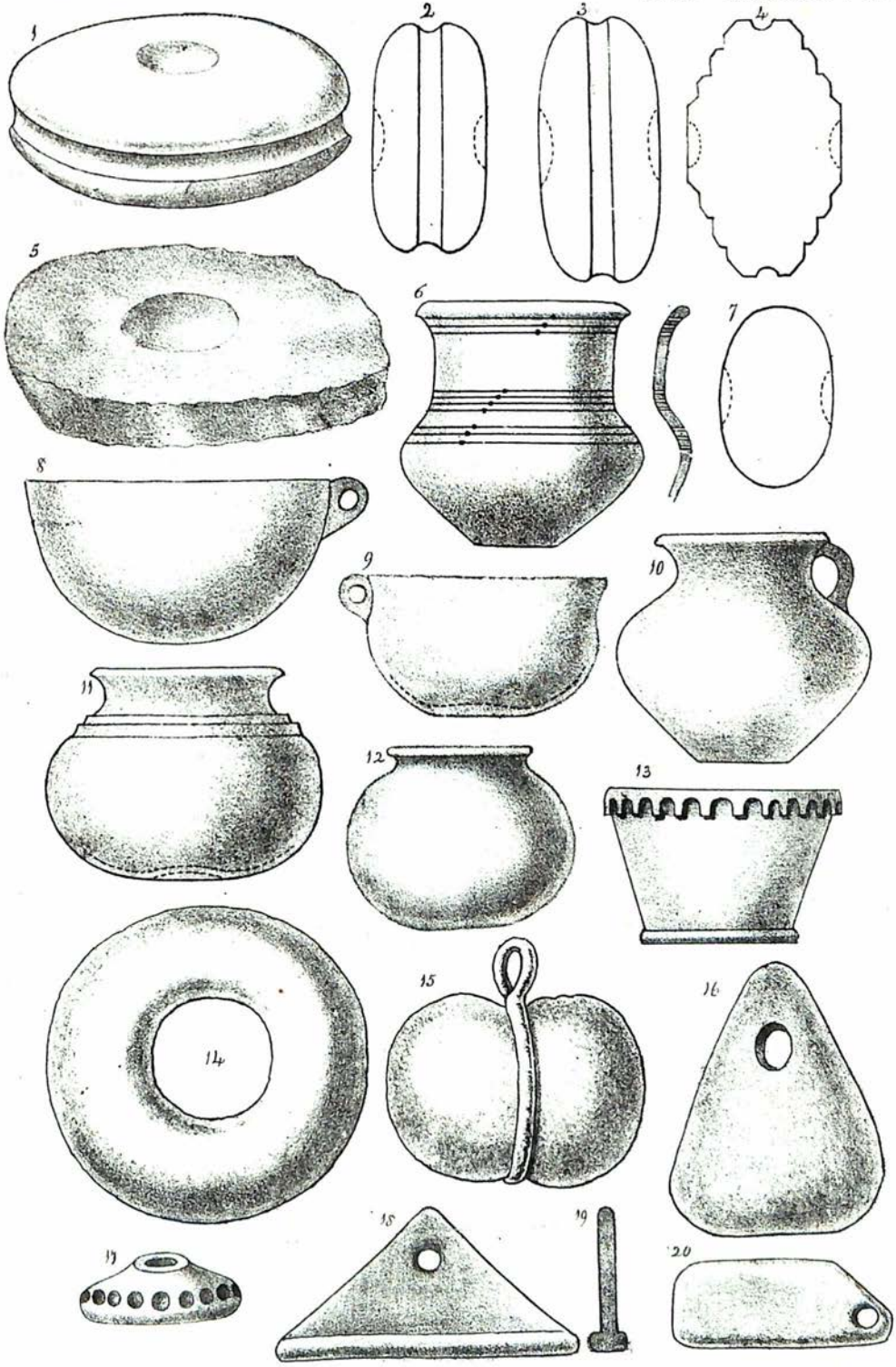


NIDAU-STEINBERG. *Bronze & Gold.*

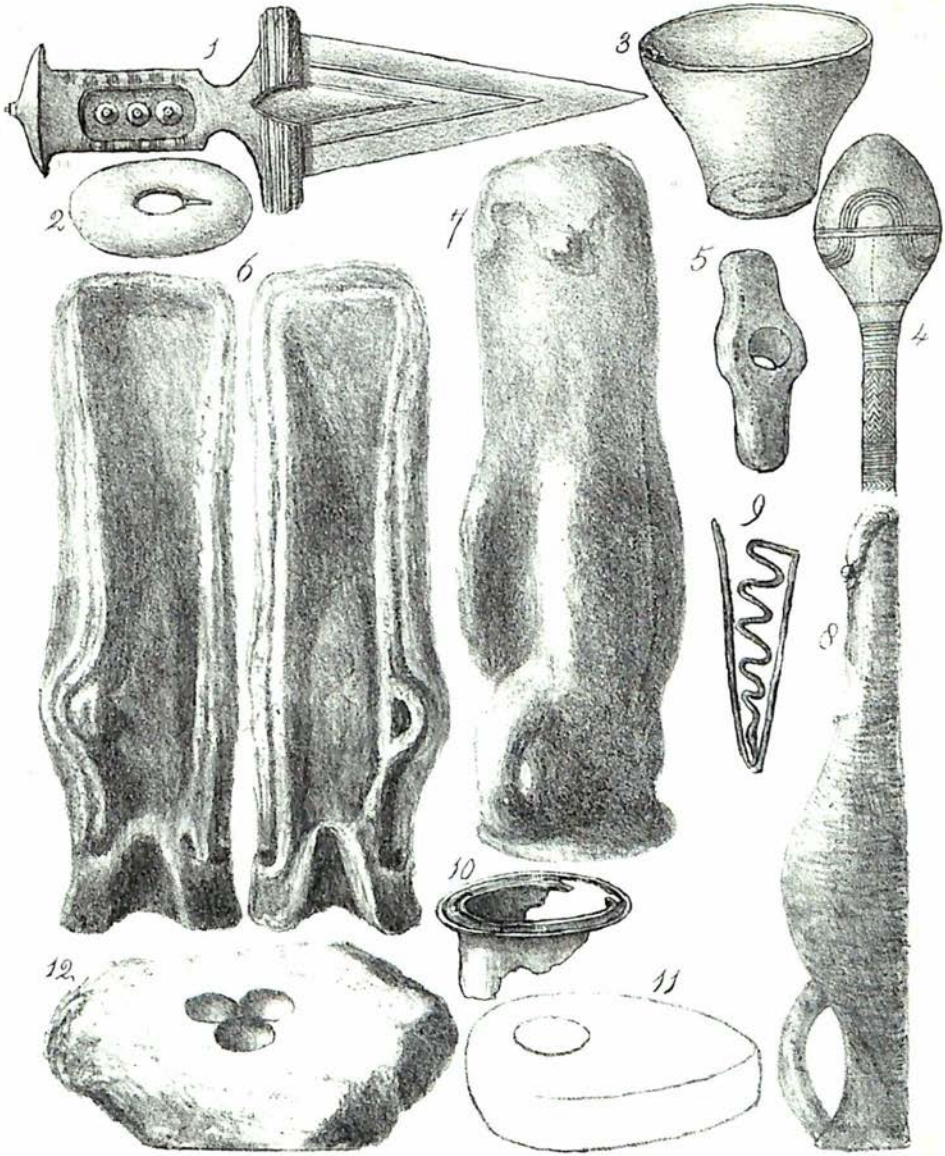
Figs. 1 to 18. 43 Full size 19. 34. to 42 ⅓ - 20 to 33 ½ size.



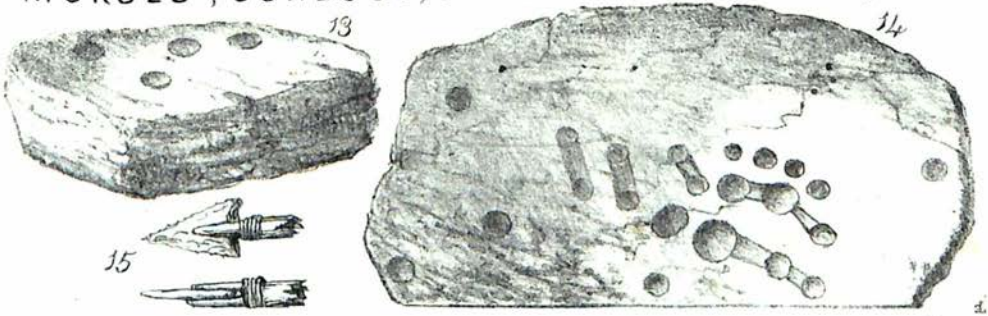
NIDAU-STEINBERG



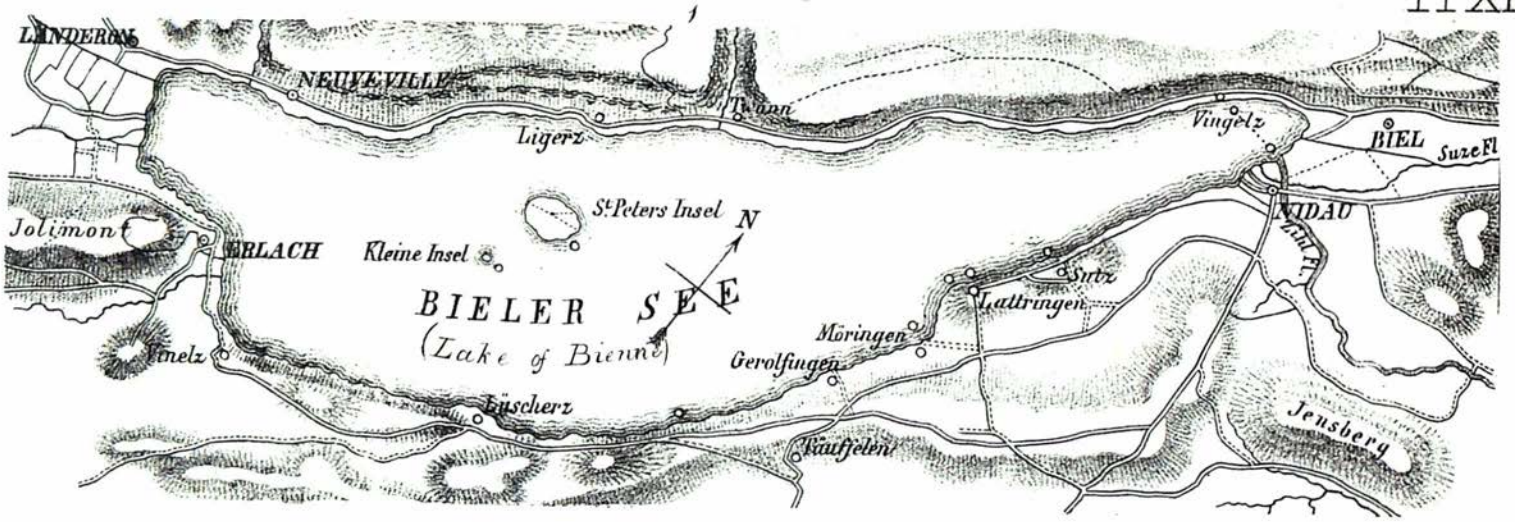
NIDAU-STEINBERG &c.



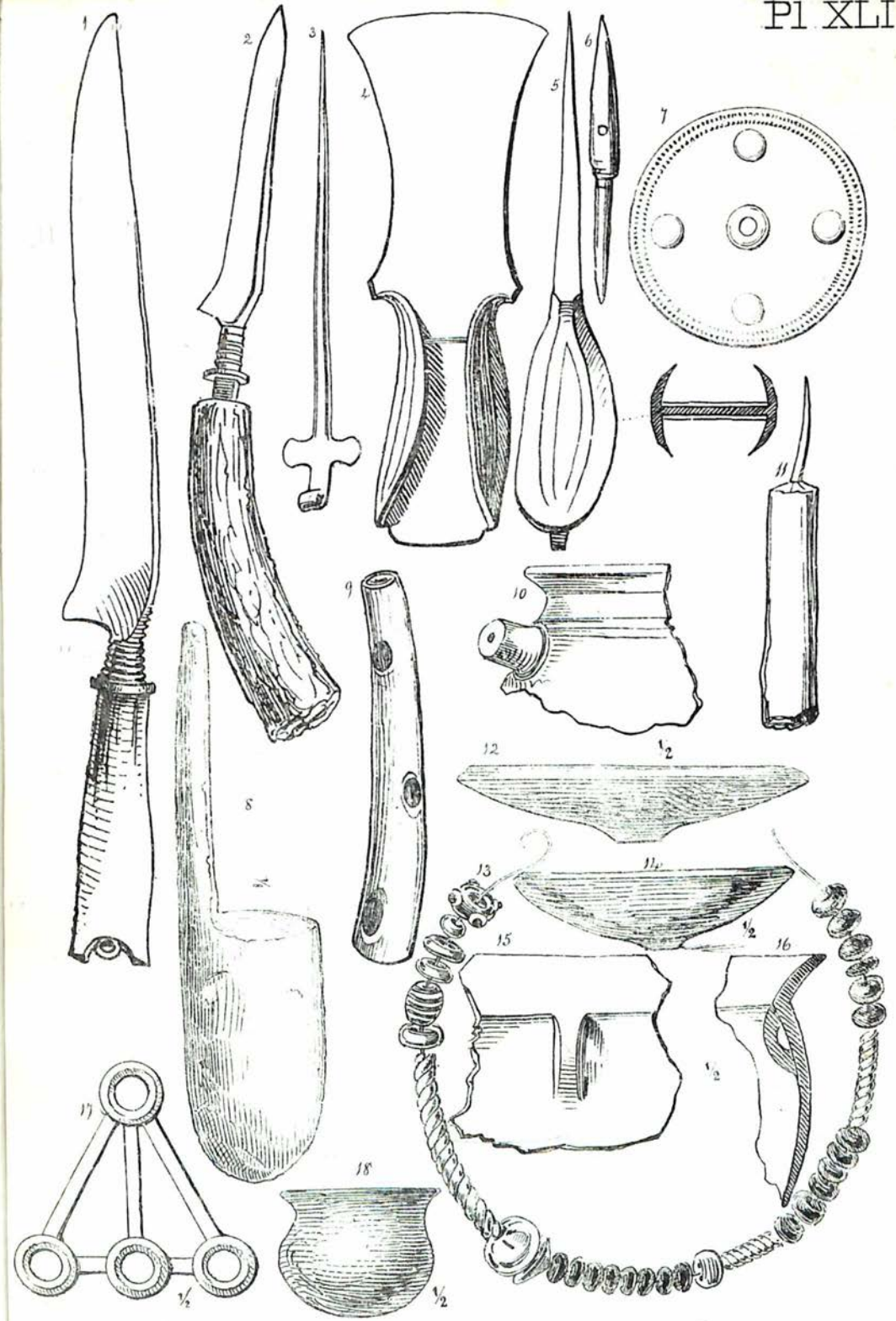
MORGES, SCHEUSS, CHEVROUX, FONT, &c



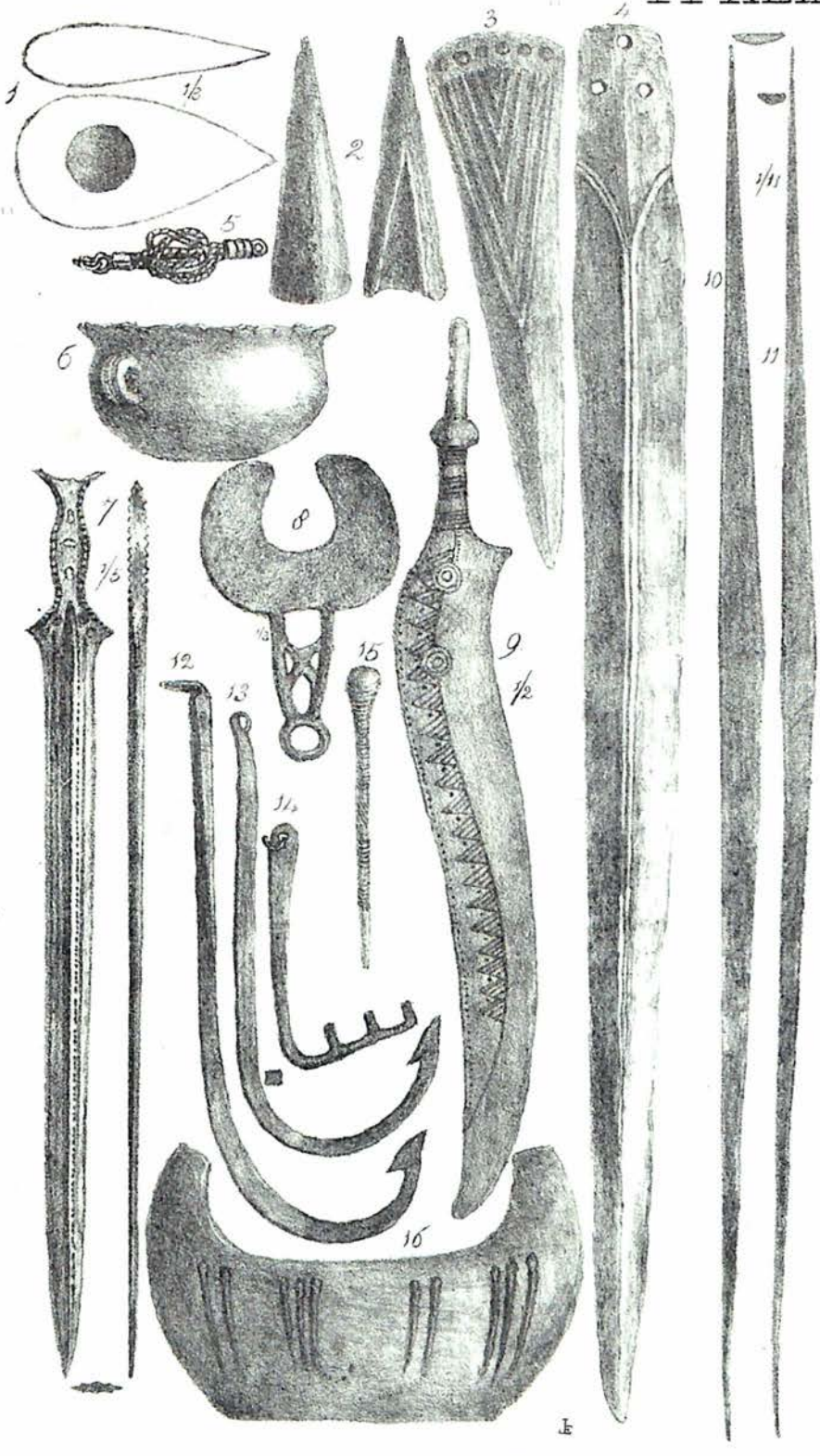
MAIN LAND FOR COMPARISON


LANDERON
NEUVEVILLE
Ligerz
Twann
Vingelz
BIEL
Suze Fl
NIDAU
Zihl Fl
St Peters Insel
N
Jolimont
ERLACH
Kleine Insel
BIELER SEE
(Lake of Bienne)
Sutz
Lattringen
Möringen
Gerolfingen
Tüscherz
Täuffelen
Jensberg
1
2
3
4
5

MÖRINGEN &c.

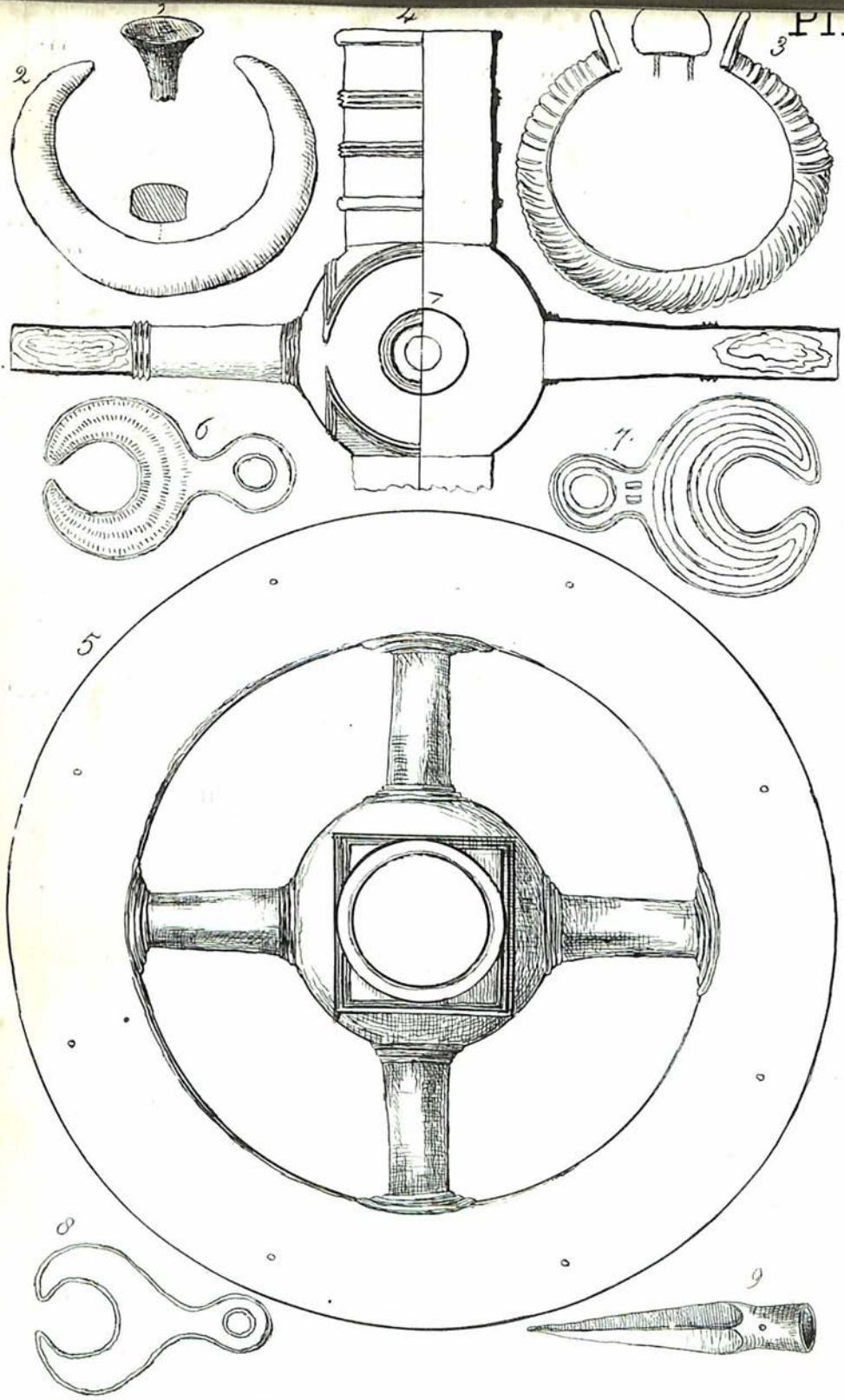


MORINGEN *Bronze &c.*



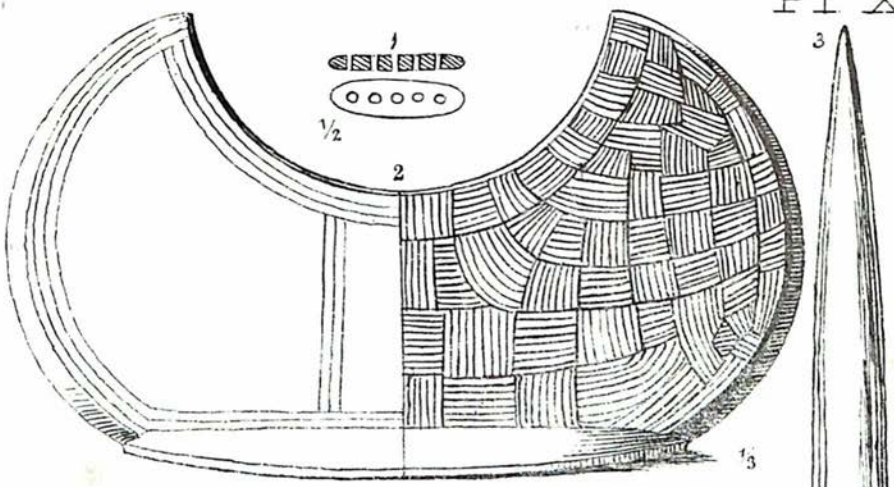
SUTZ, LATTRINGEN &c.

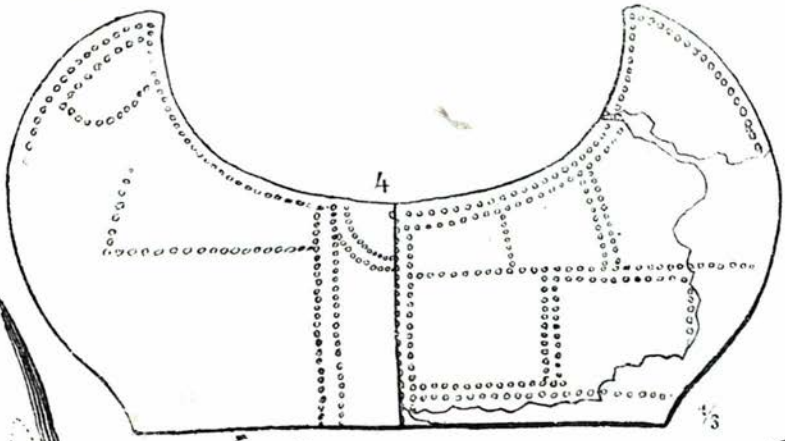
CORTAILLOD &c.

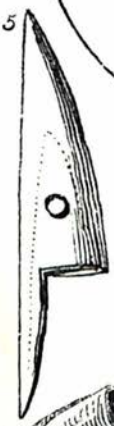


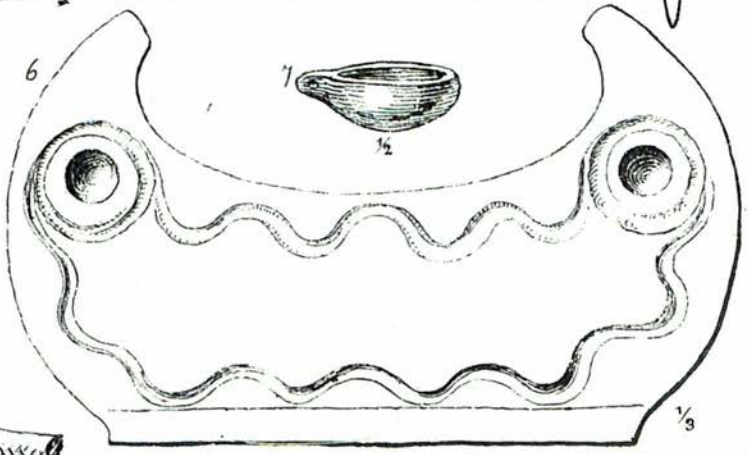
CORTAILLOD *Bronze.*

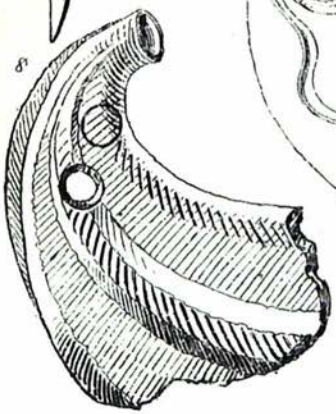
Fig. 4 & 5 Quarter Size-Remainder Half Size.

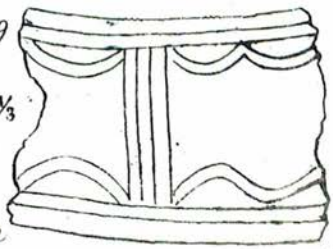




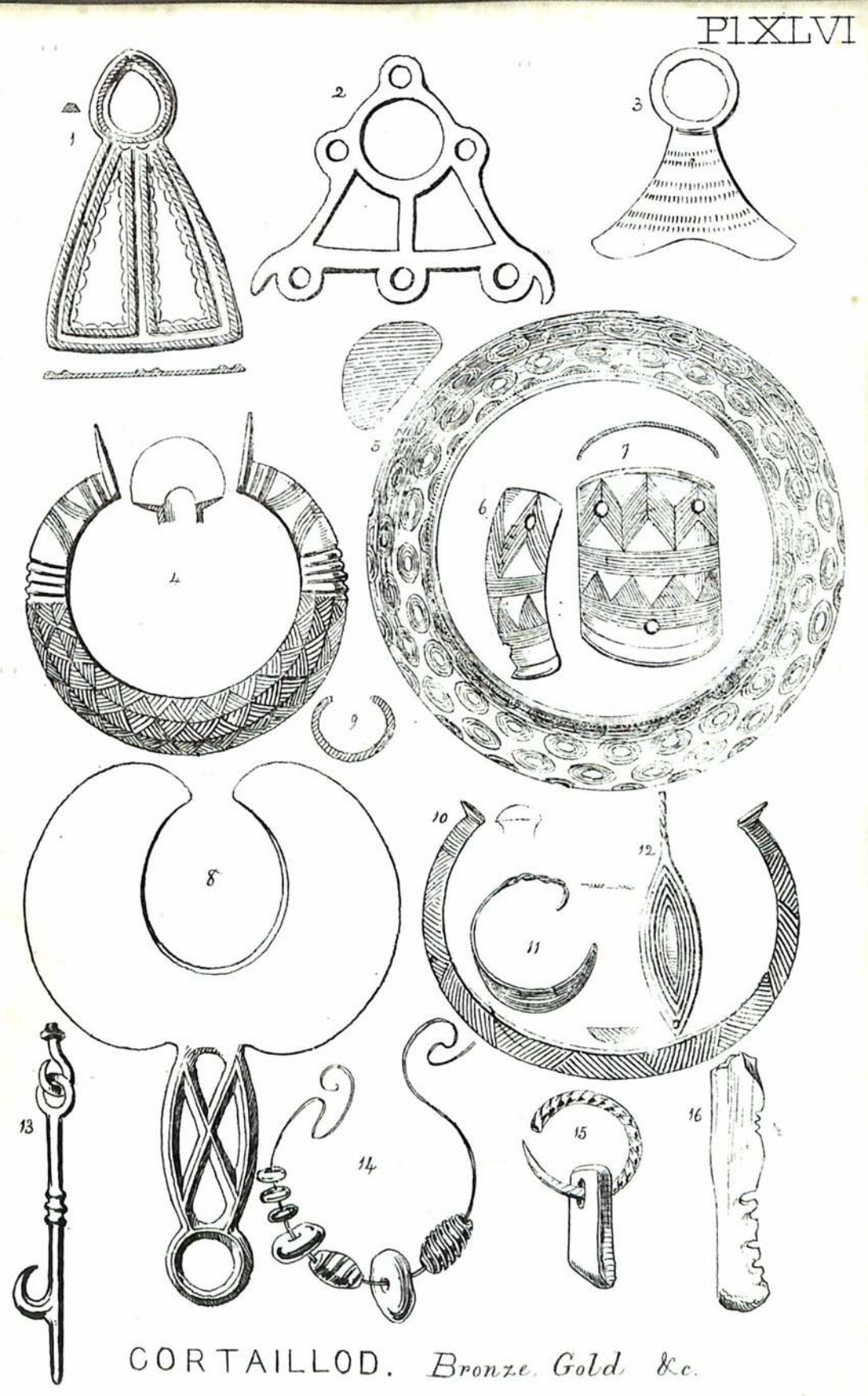




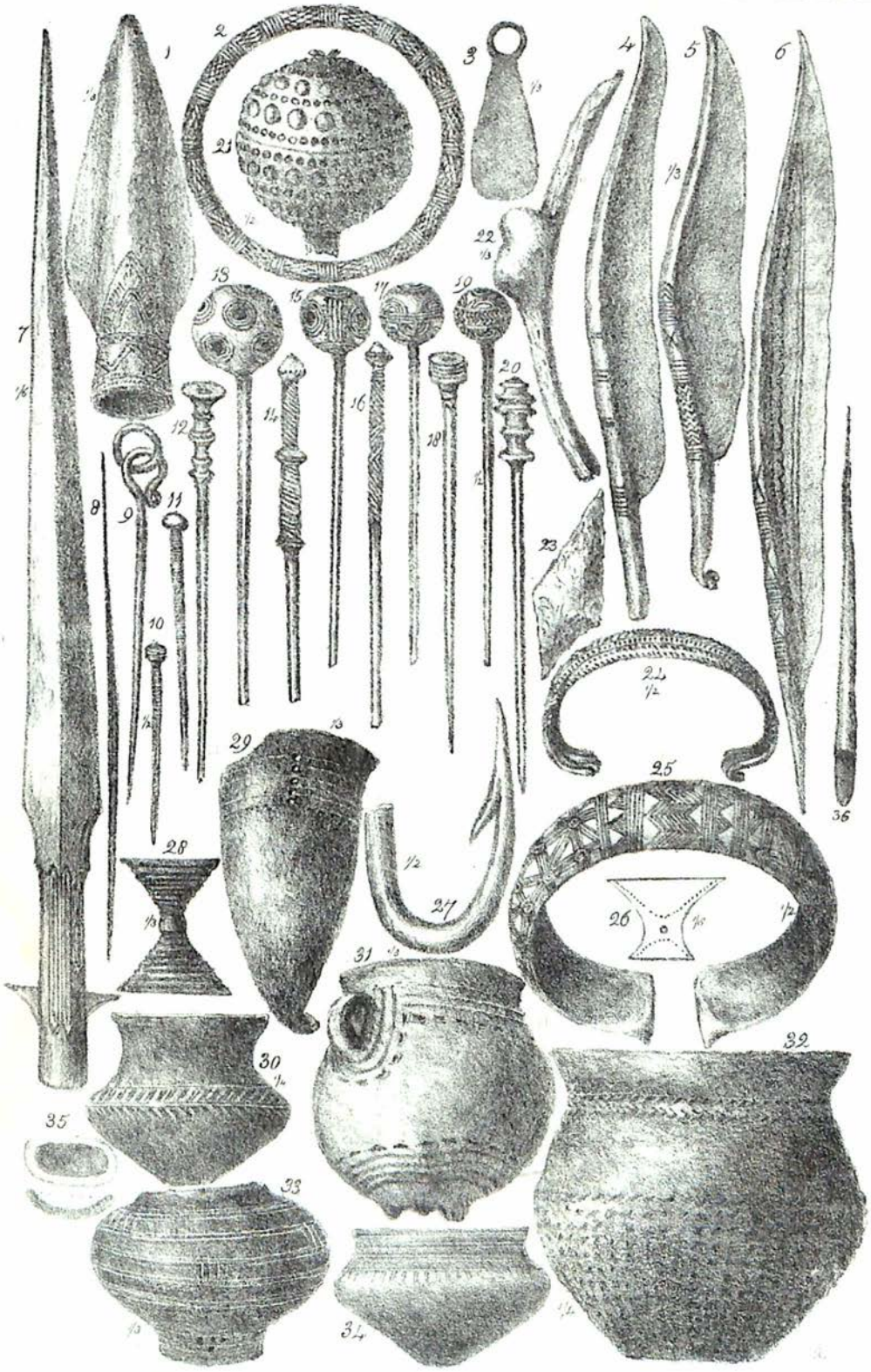




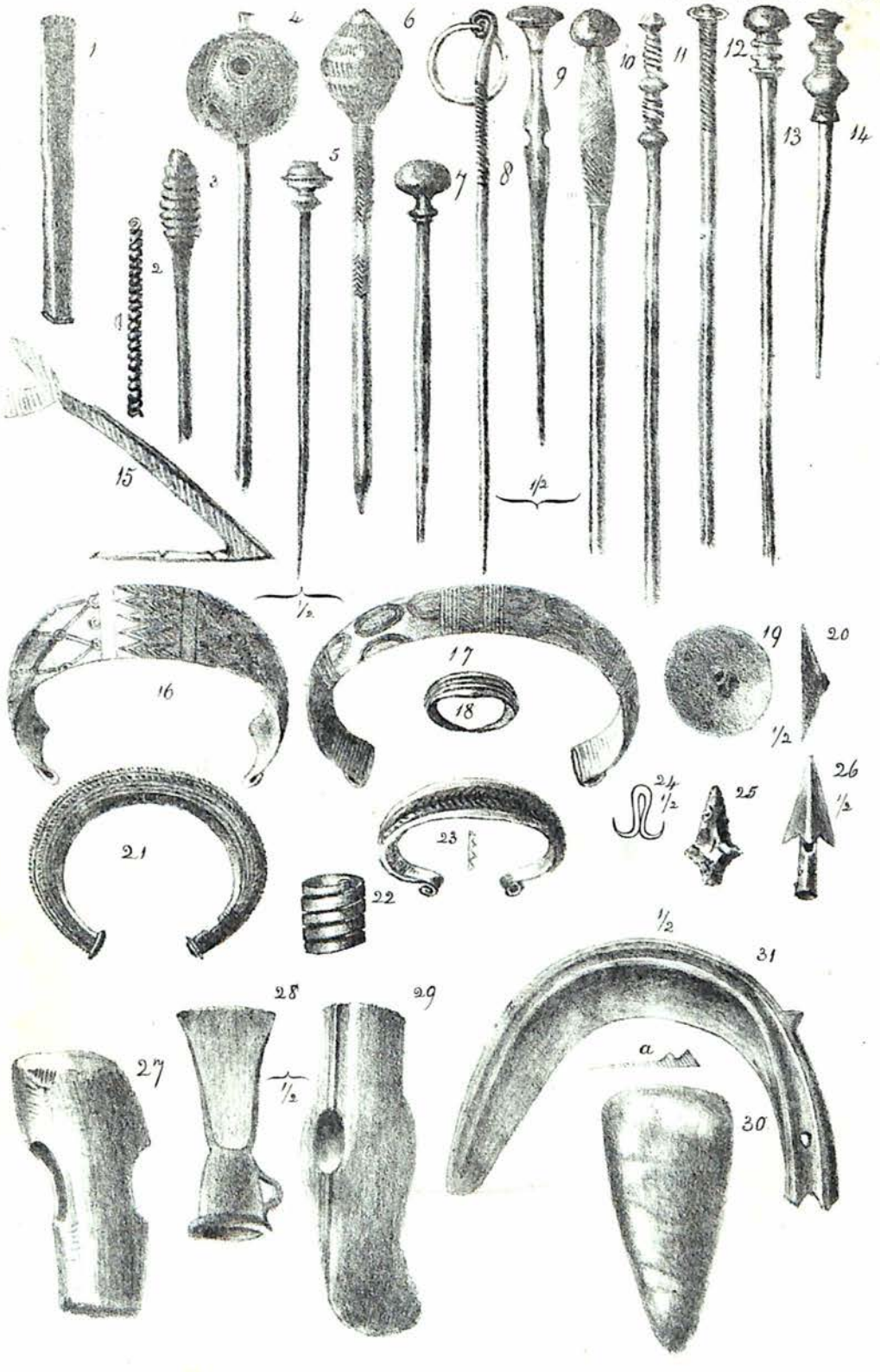
CORTAILLOD *Earthenware &c*



CORTAILLOD. *Bronze, Gold &c.*



AUVERNIER &c.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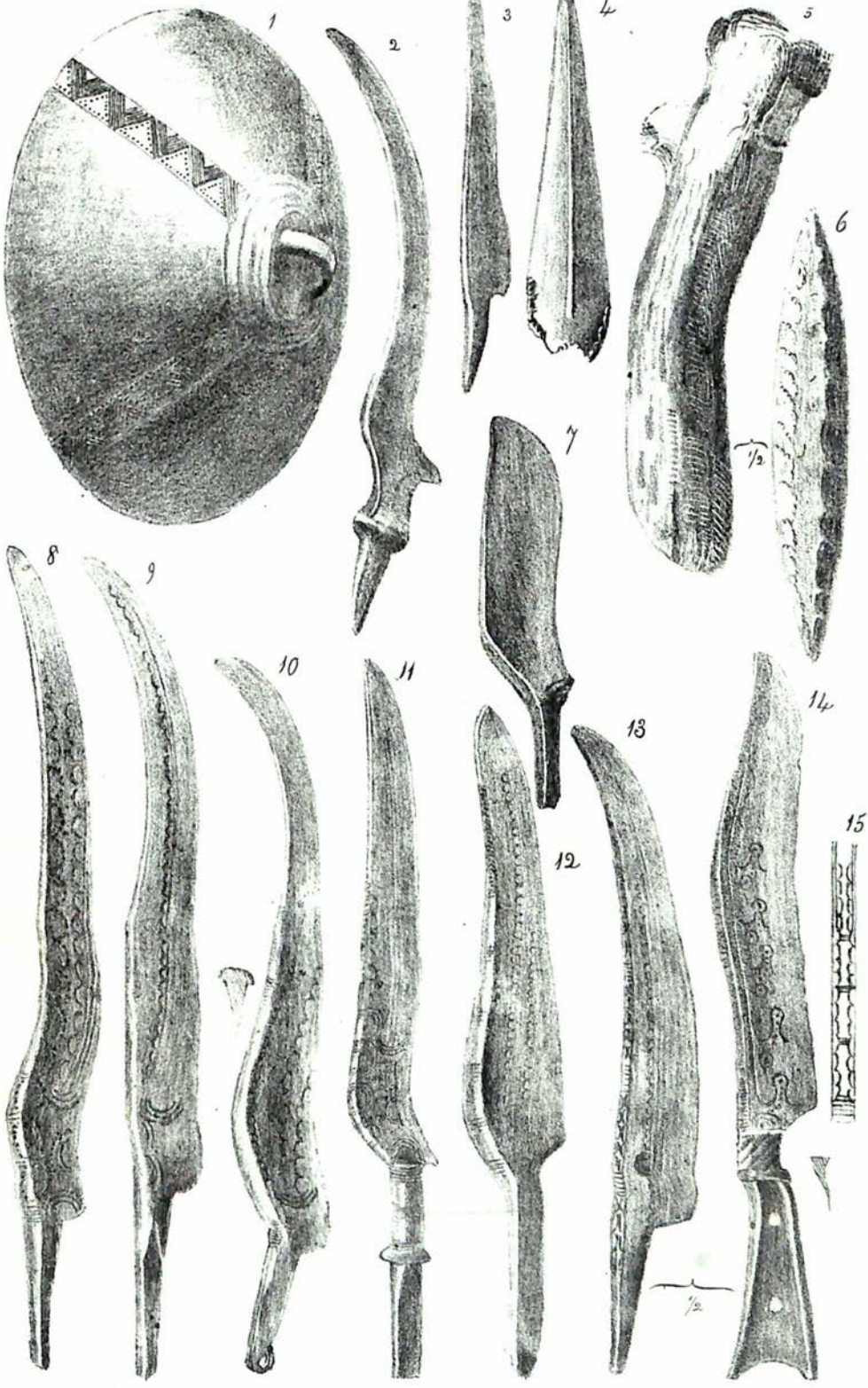
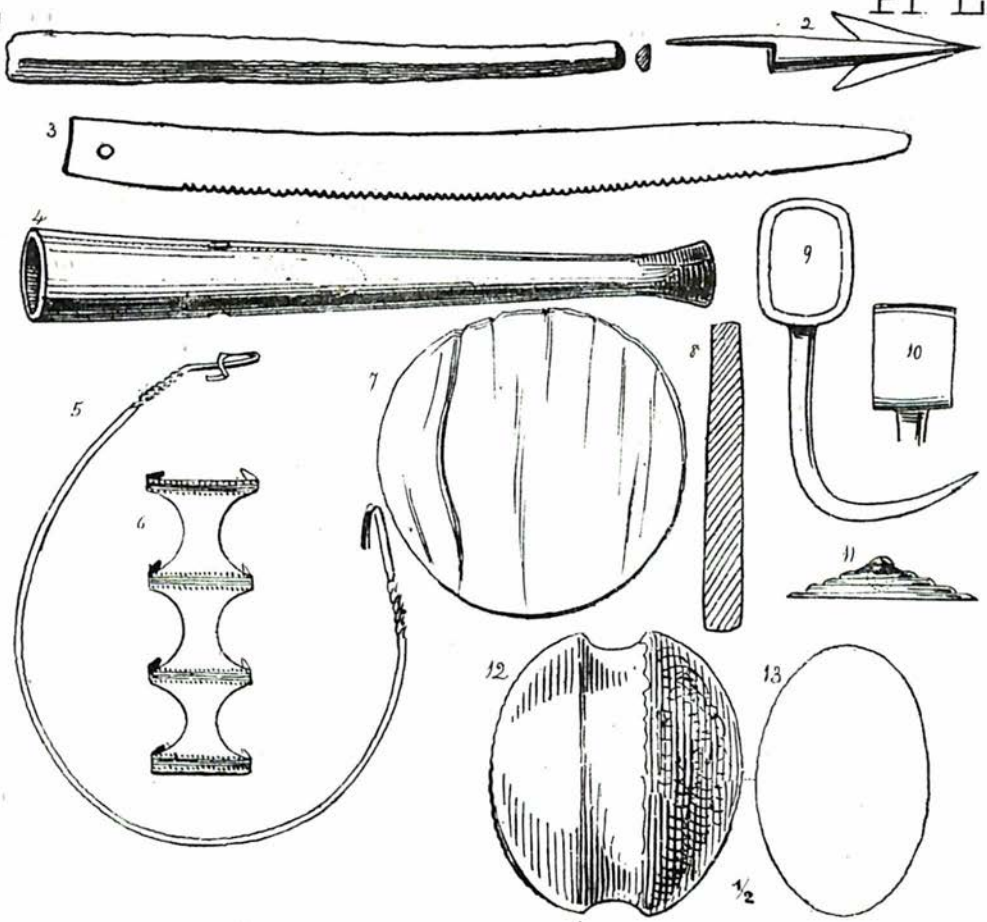
ESTAVAYER.

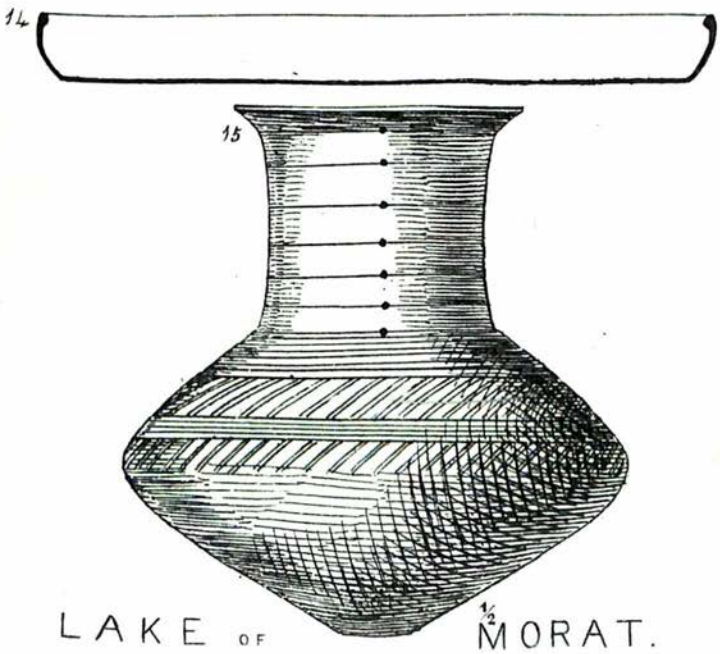
Pl XLIX



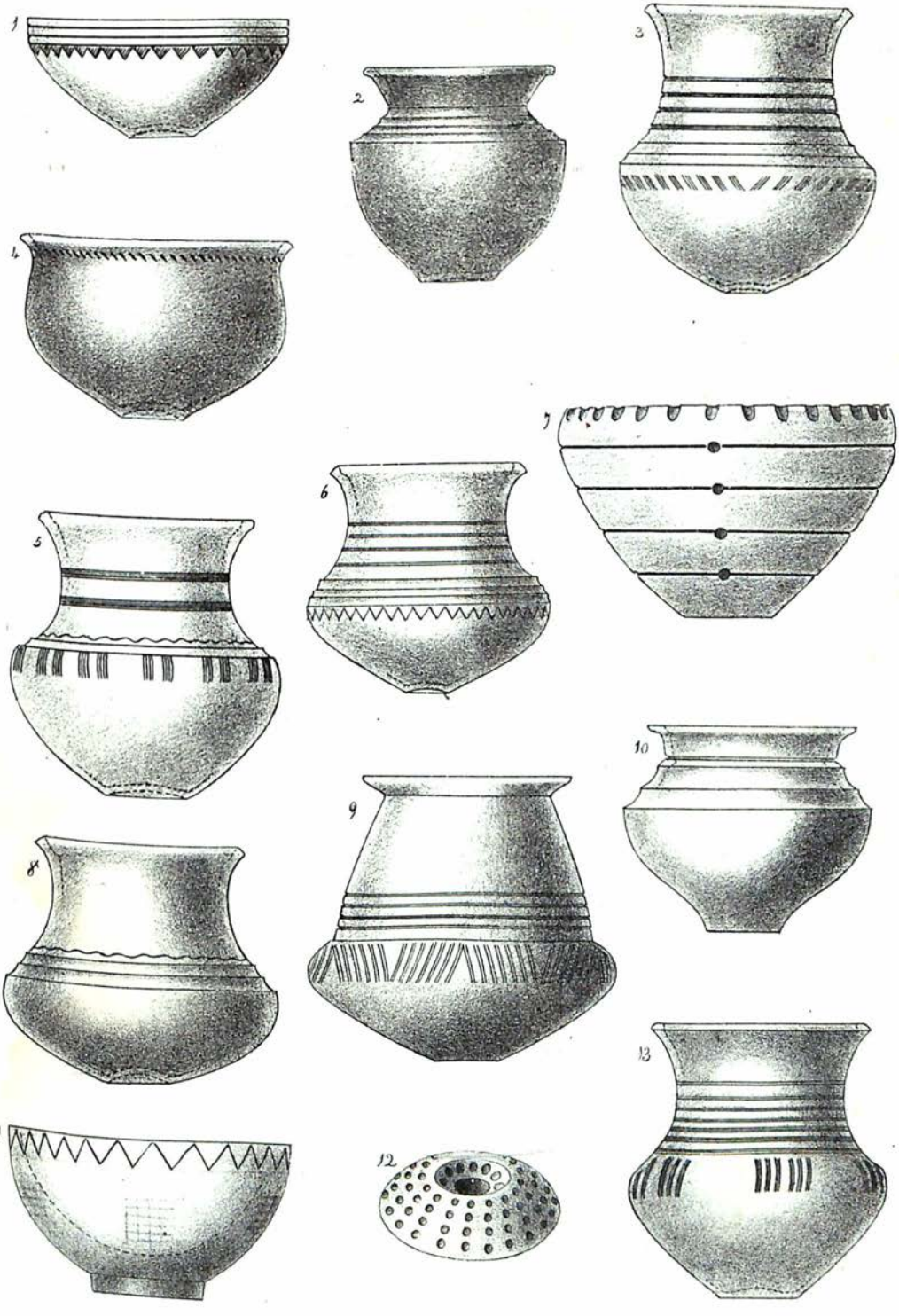
ESTAVAYER &c



ESTAVAYER *Tin Bronze &c.*



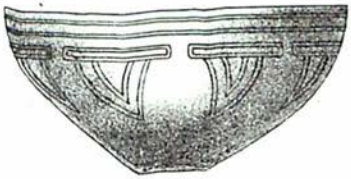
LAKE OF MORAT.



MONTELLIER.

all ⅓

1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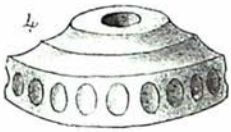
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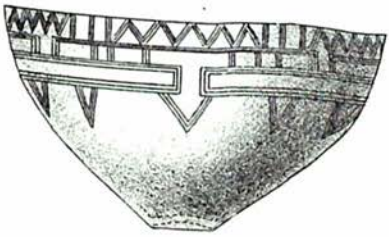
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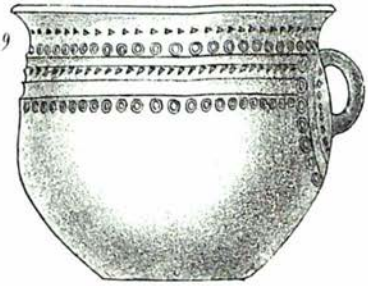
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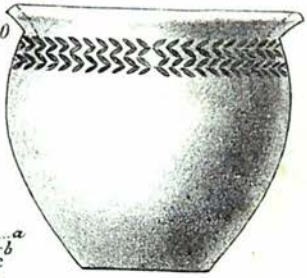
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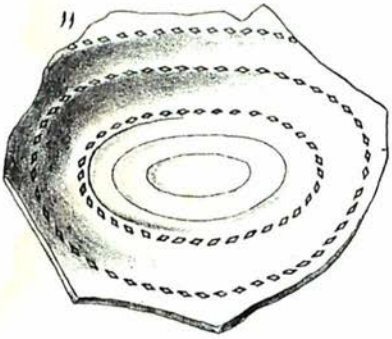
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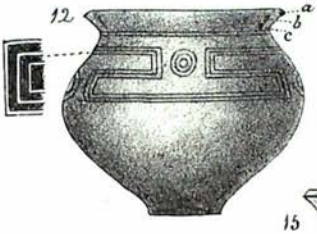
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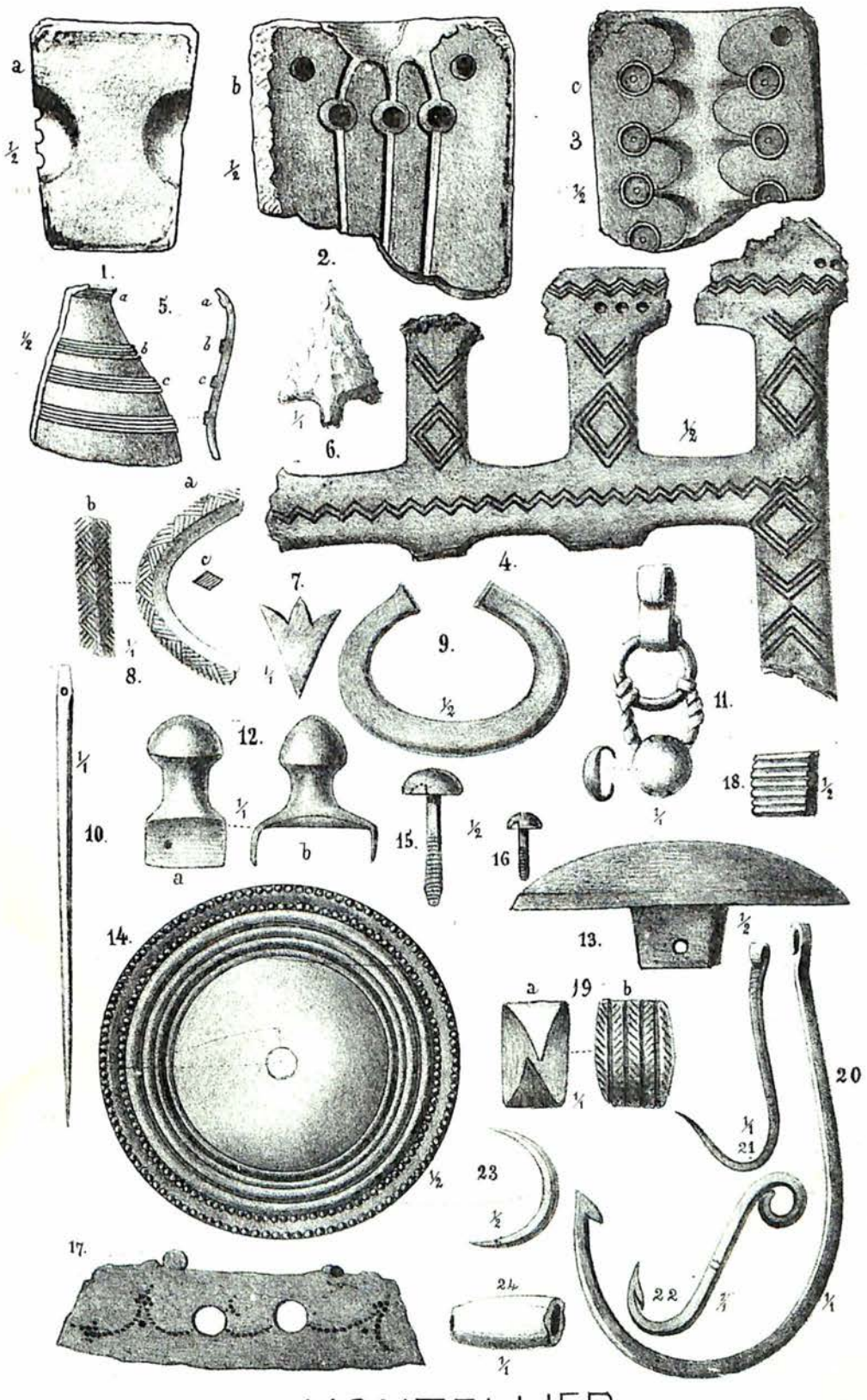
MONTELLIER.

all ⅓ except Figure Eight.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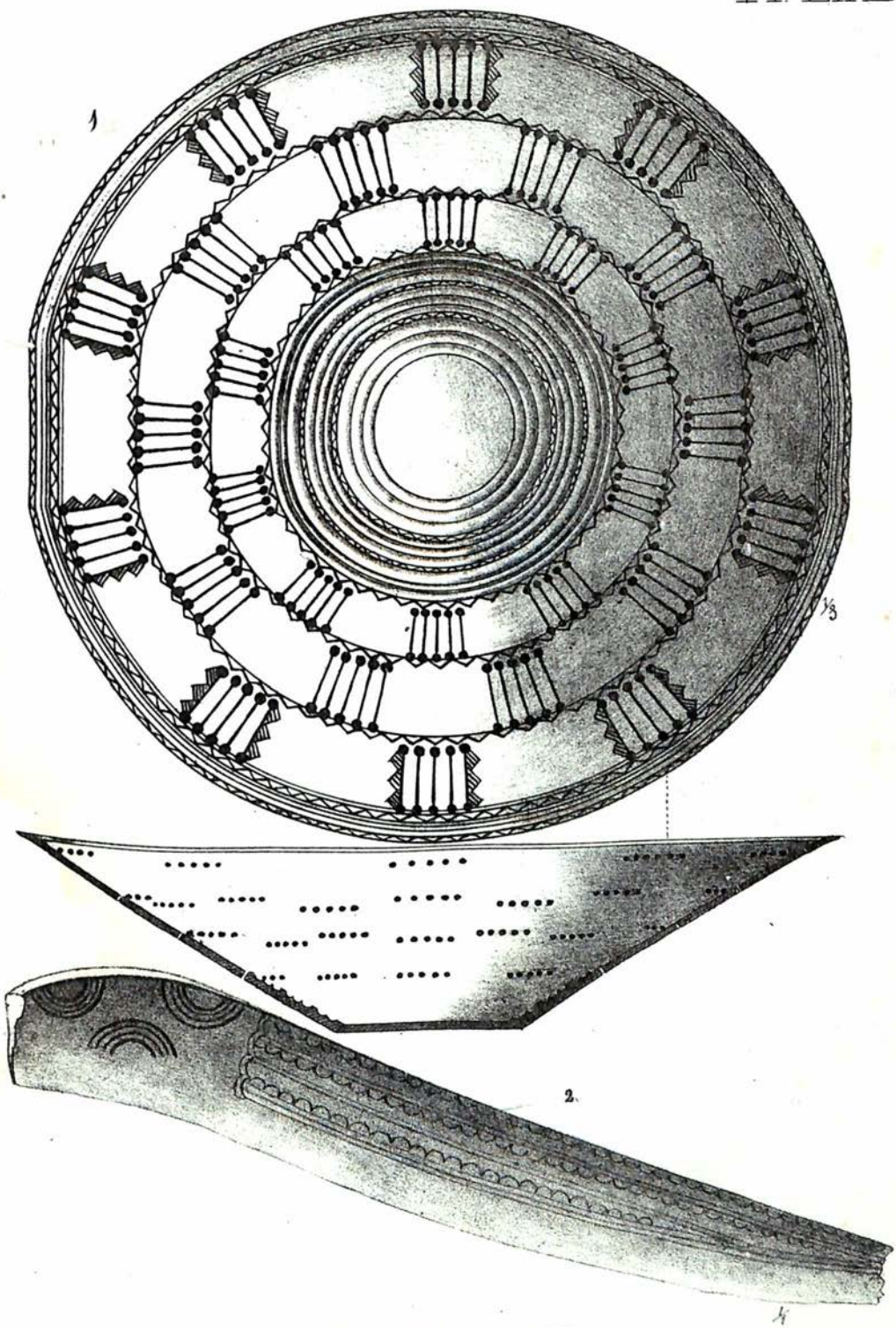
MONTELLIER.



MONTELLIER.

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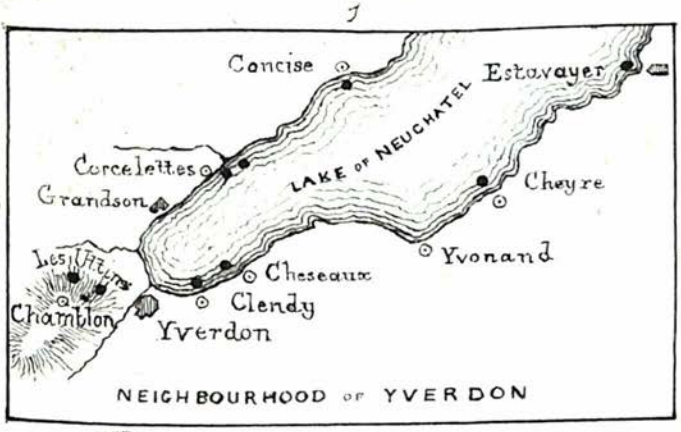

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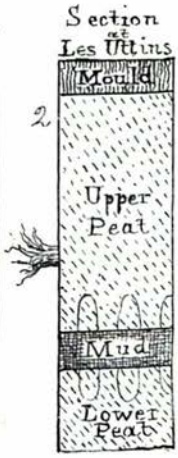

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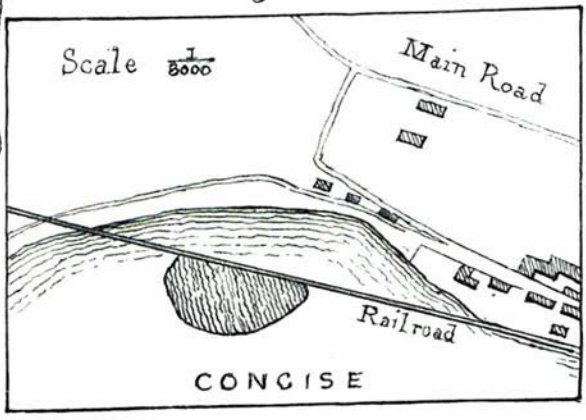

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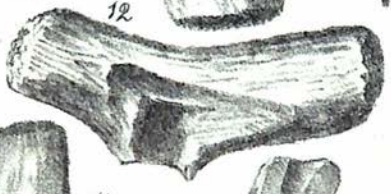

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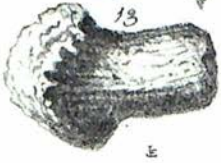

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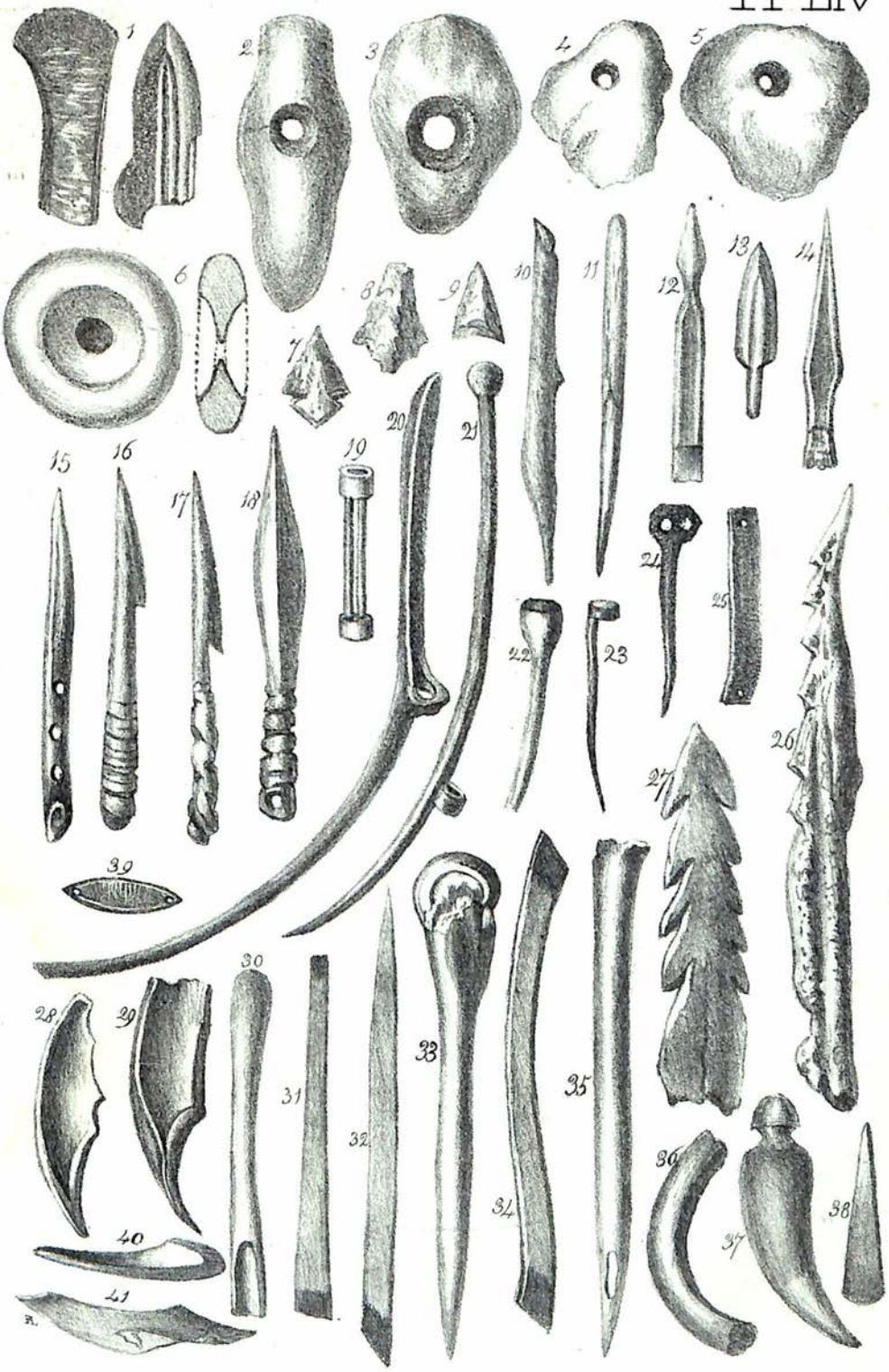
CONCISE &c.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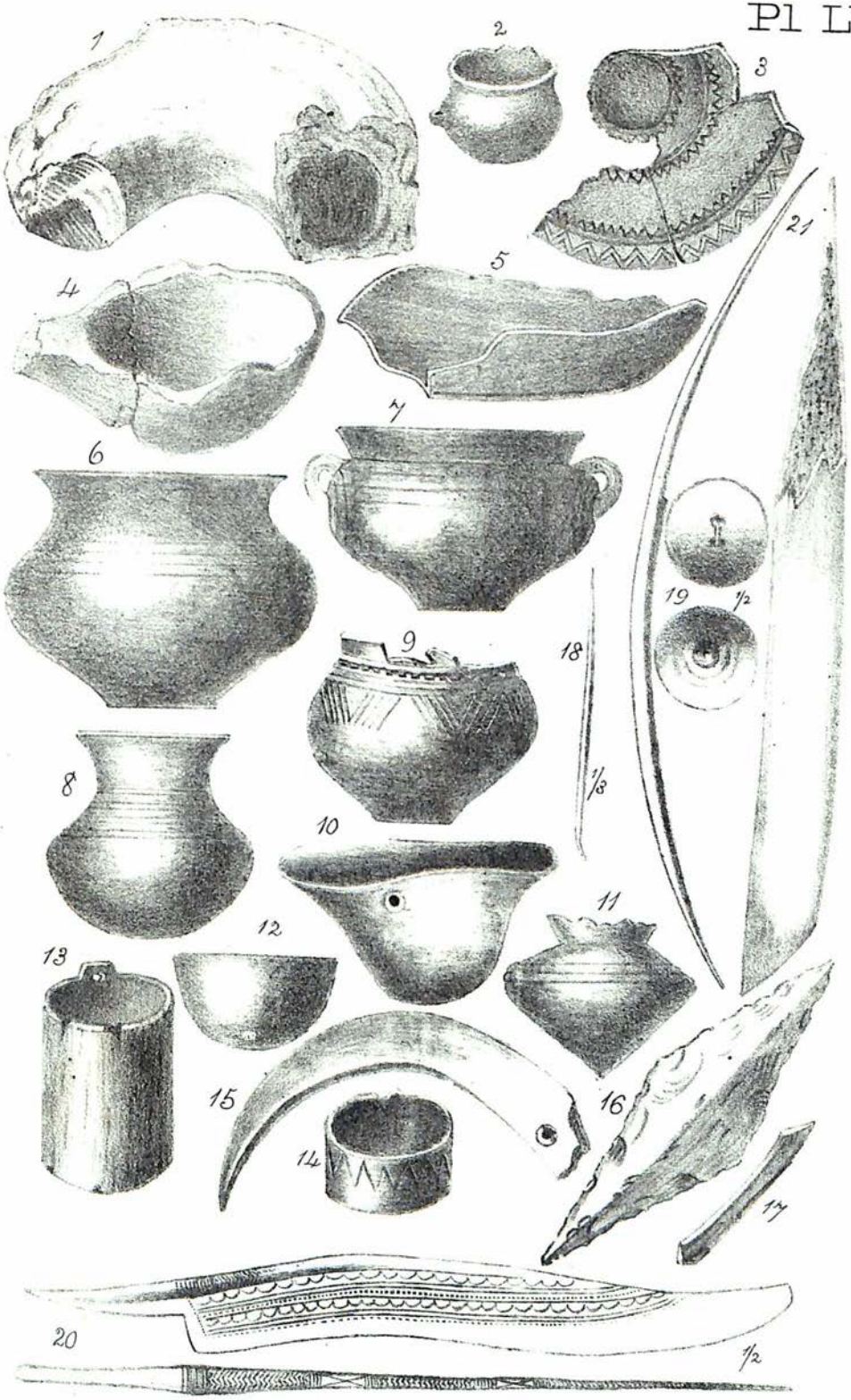
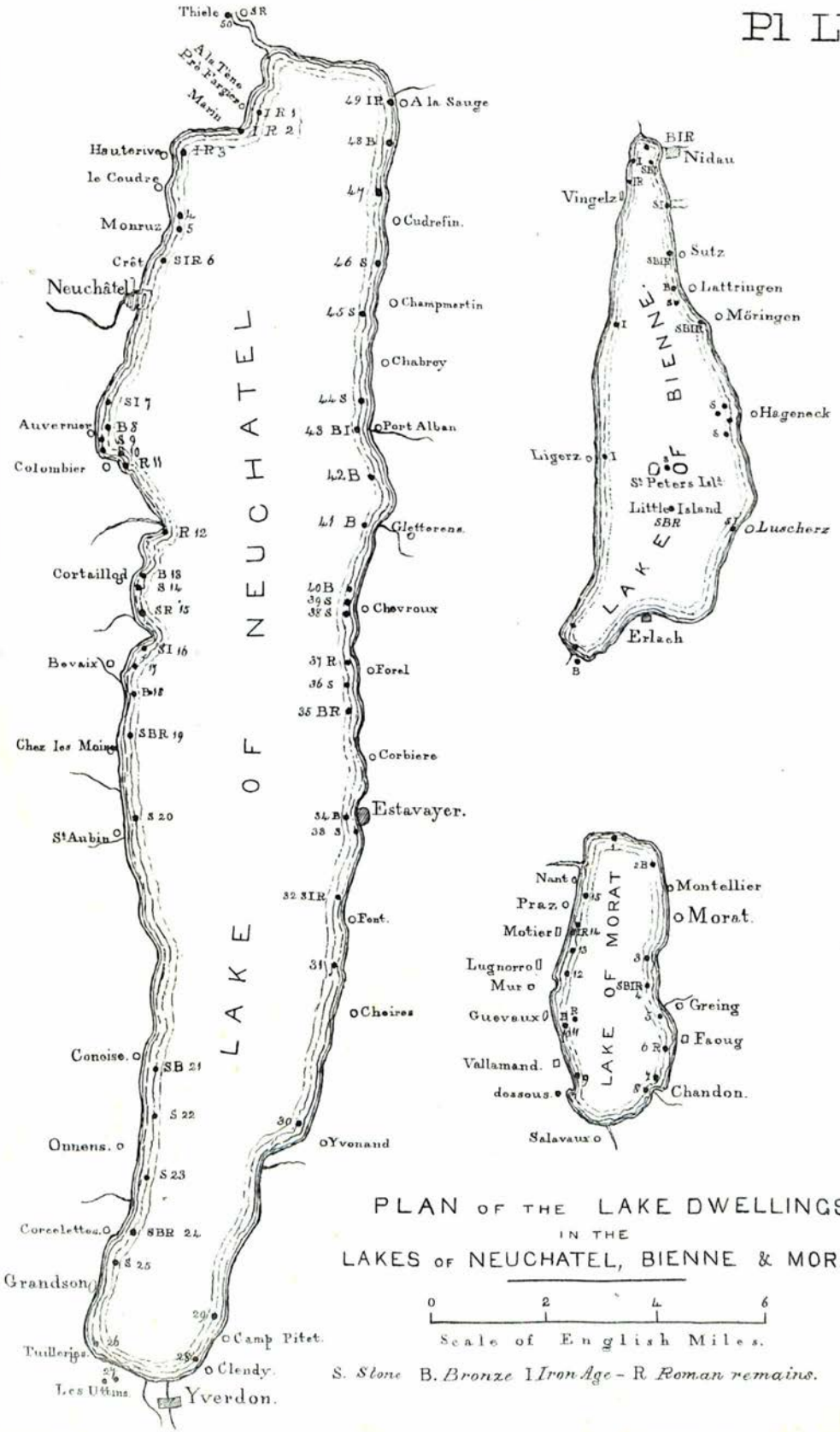
CONCISE &c



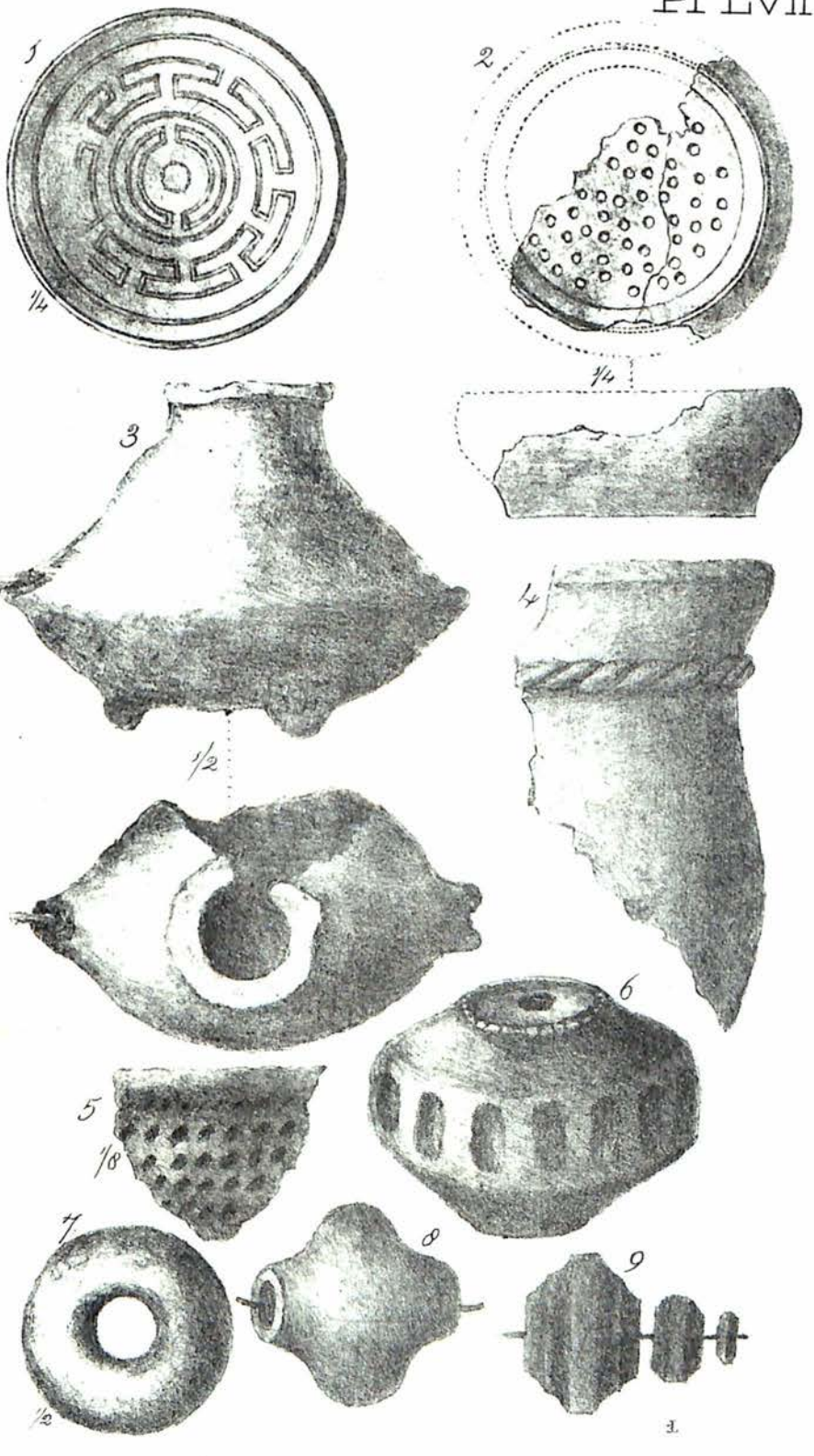
CONCISE, &c.



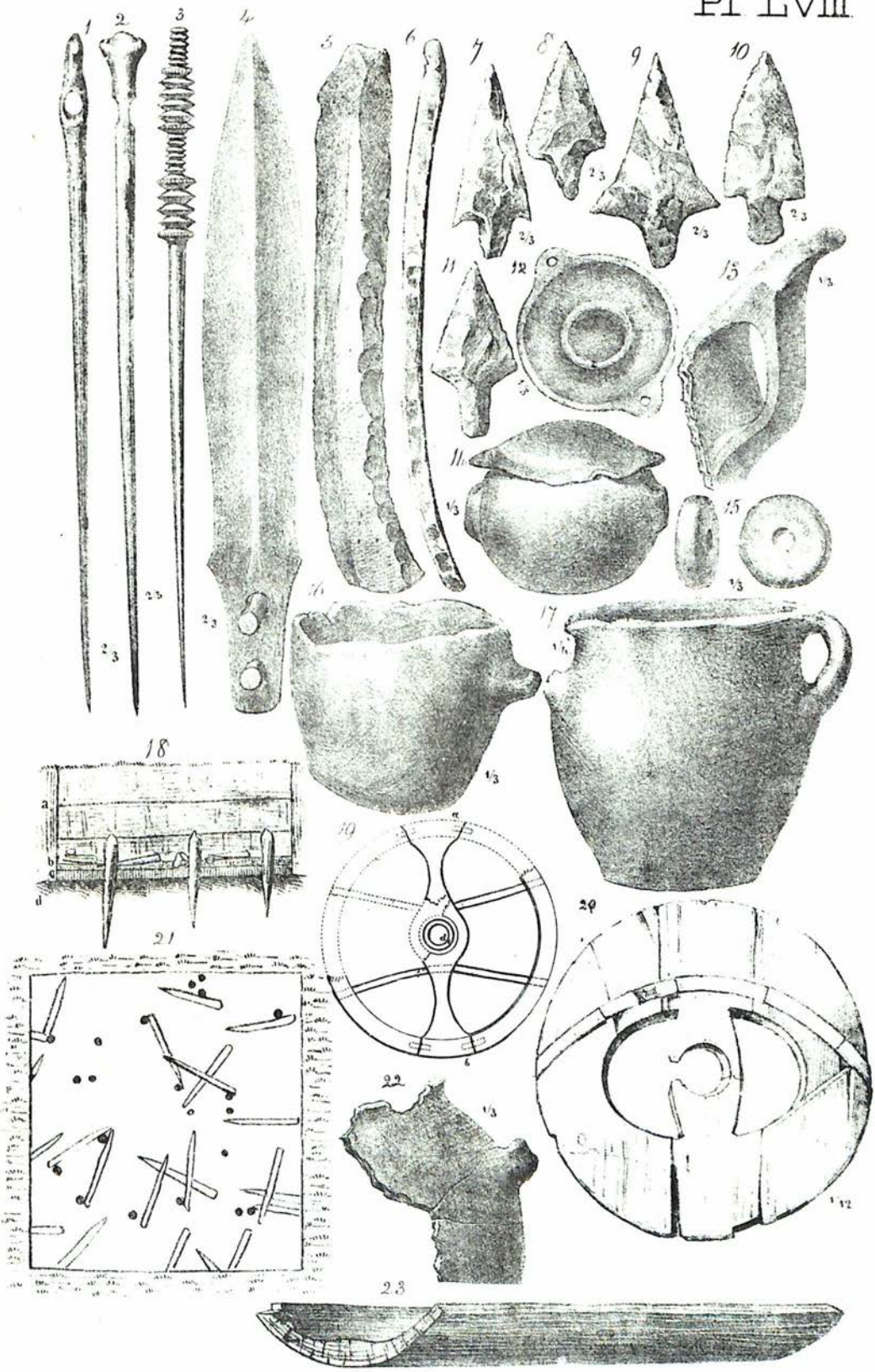
PLAN OF THE LAKE DWELLINGS IN THE LAKES OF NEUCHATEL, BIENNE & MORAT

Scale of English Miles.

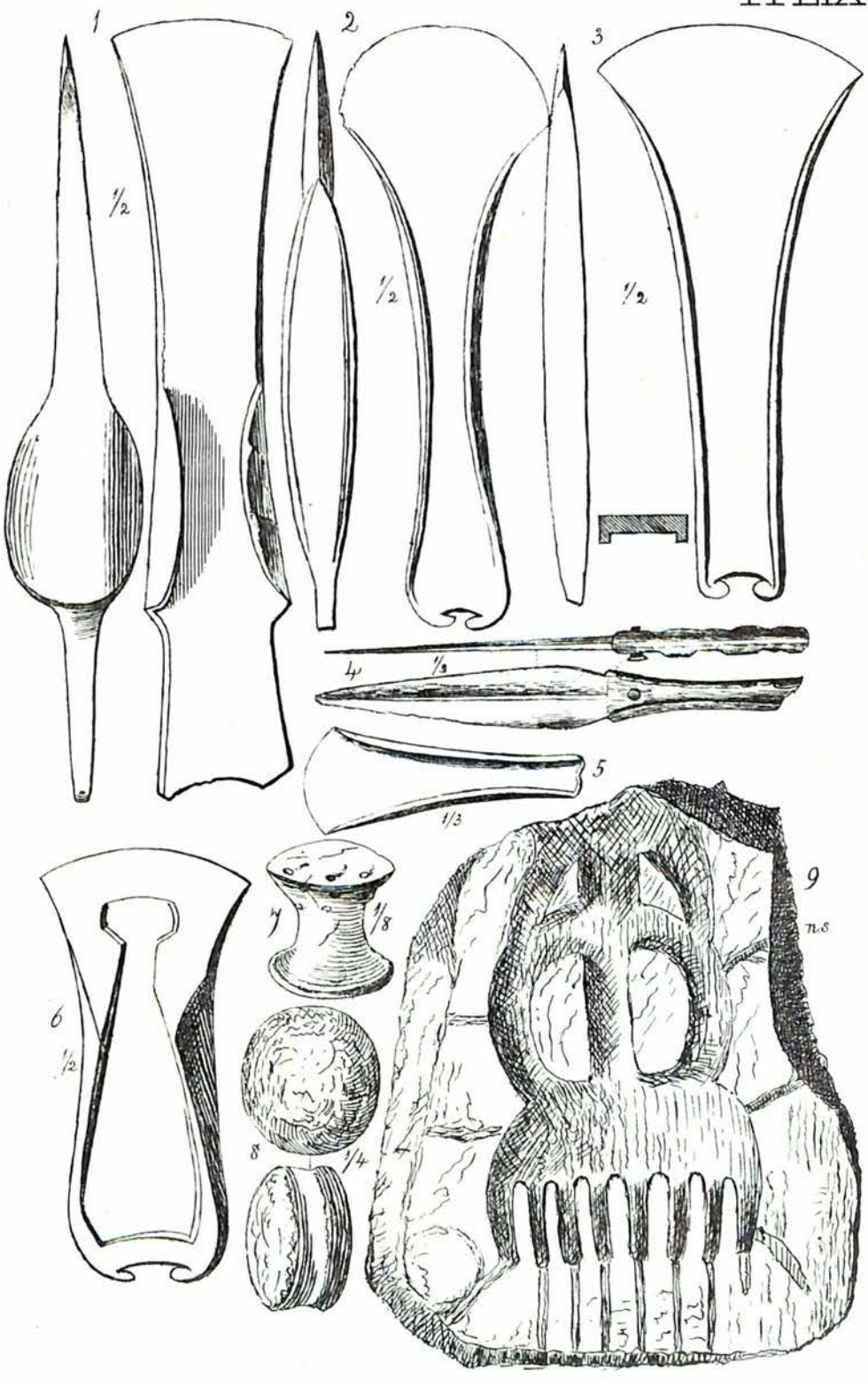
S. *Stone* B. *Bronze* I *Iron Age* – R *Roman remains.*



LAKE OF BOURGET.



MERCURAGO.



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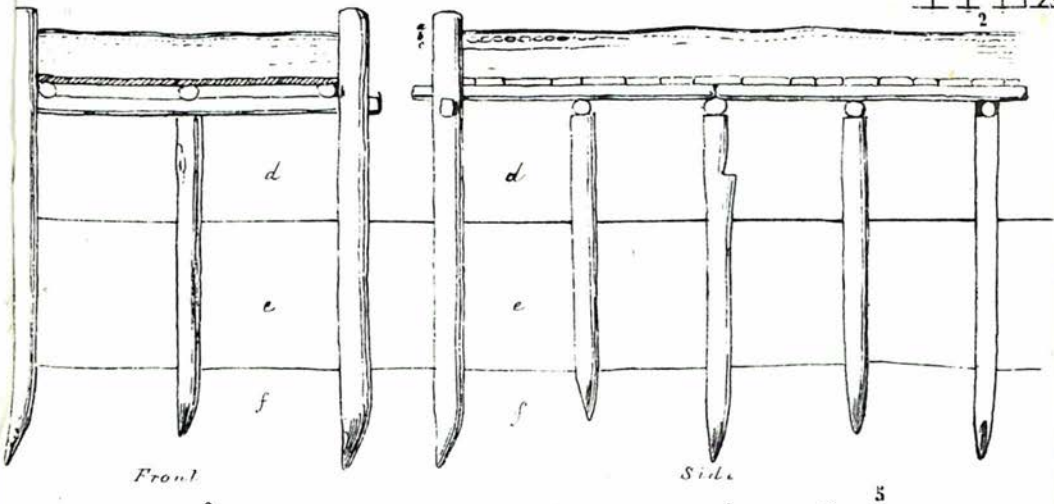
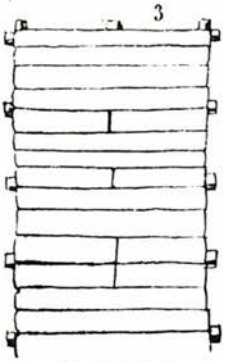
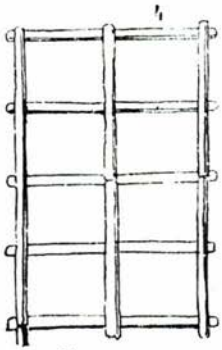
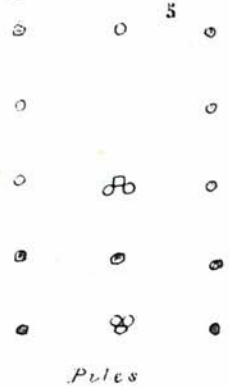
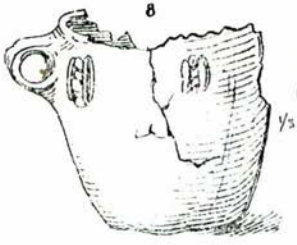
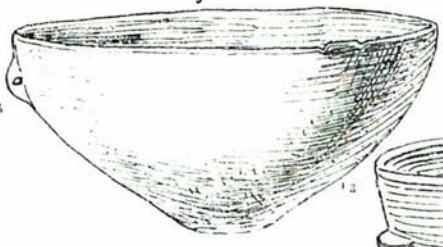


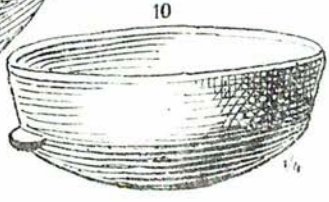






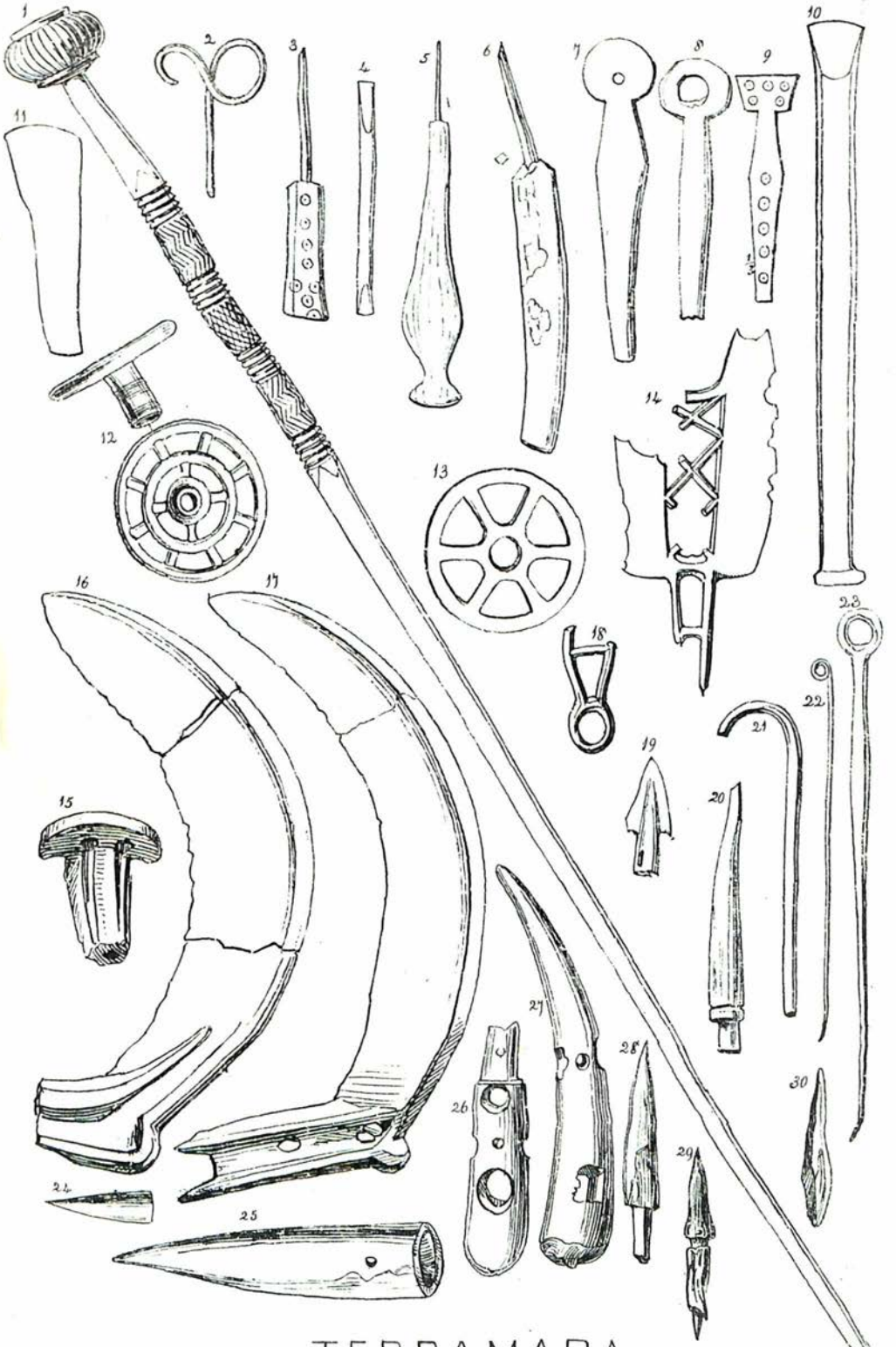






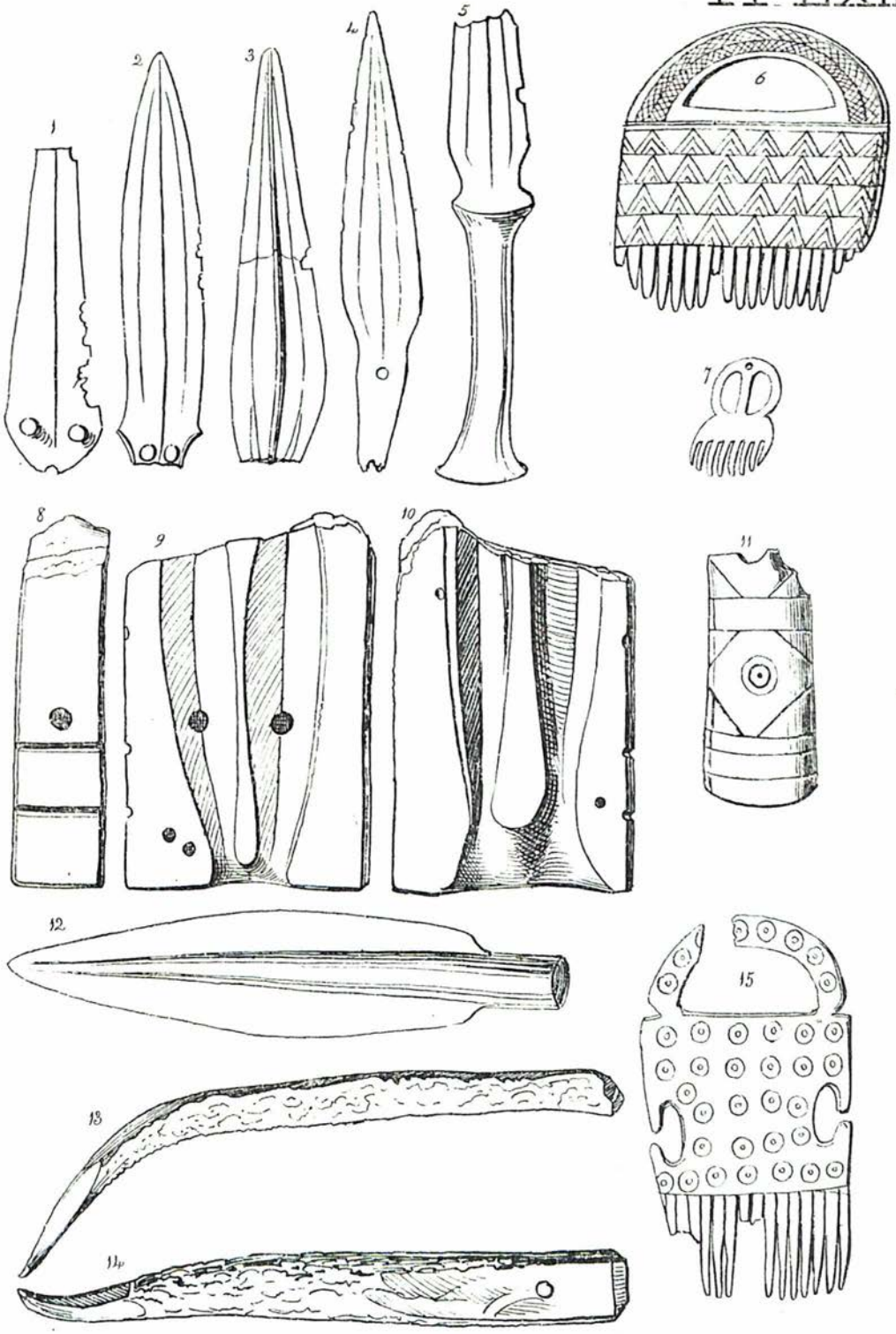
TERRAMARA

TERRAMARA.



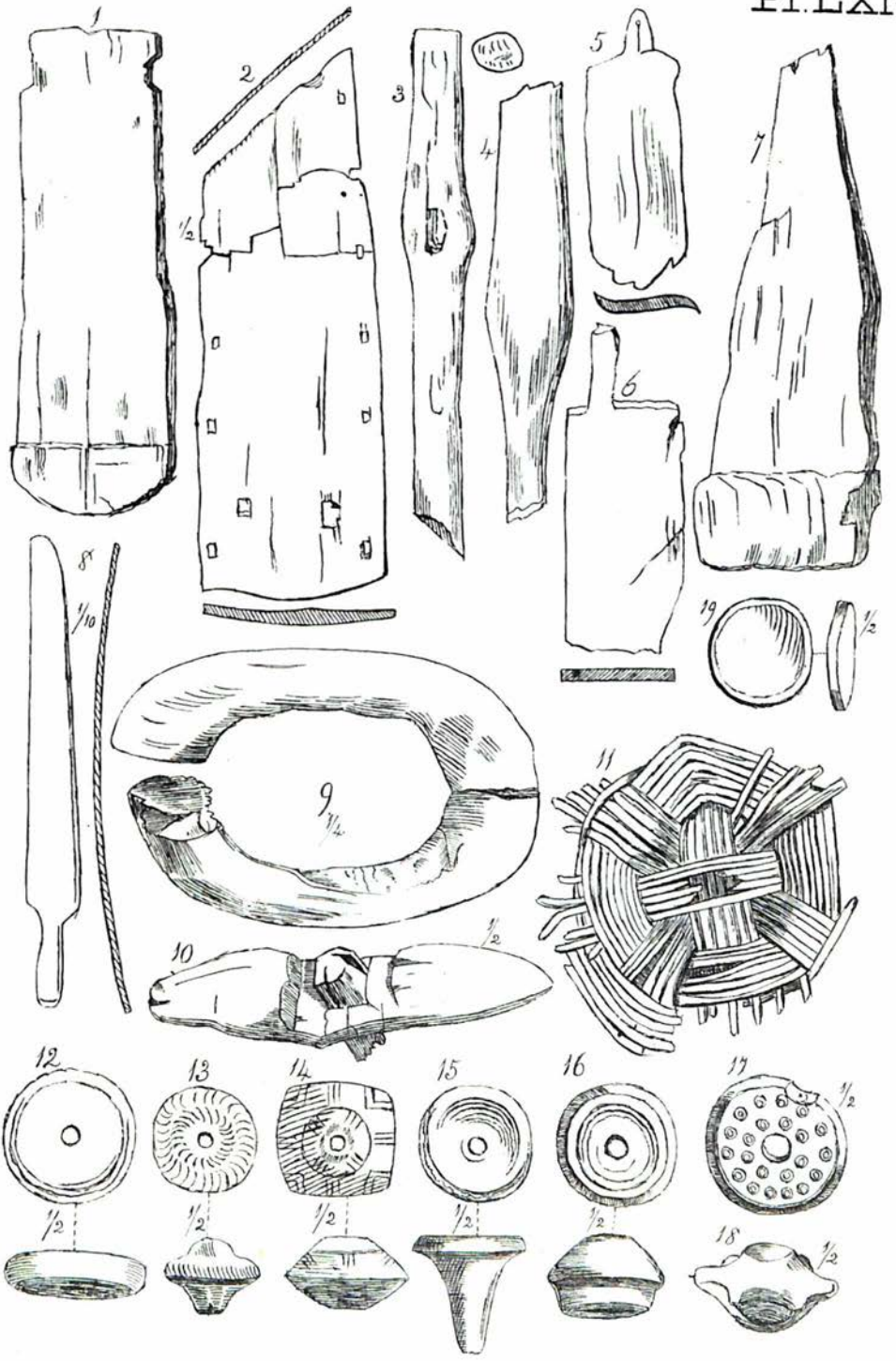
TERRAMARA.

No 1 Full size – Remainder ½ size.



TERRAMARA.

Figs 10 & 12 Full size 11 ⅓ Rem^r ½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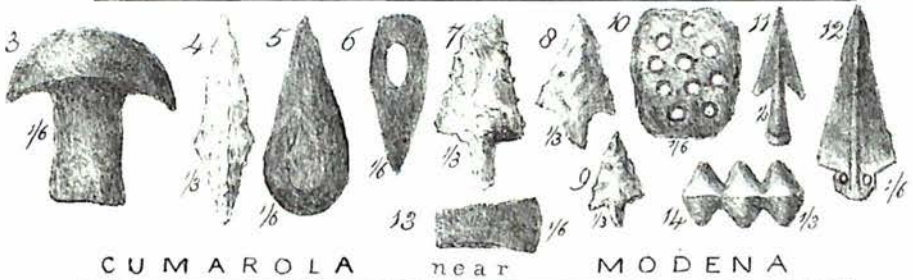
TERRAMARA.

FOR COMPARISON.

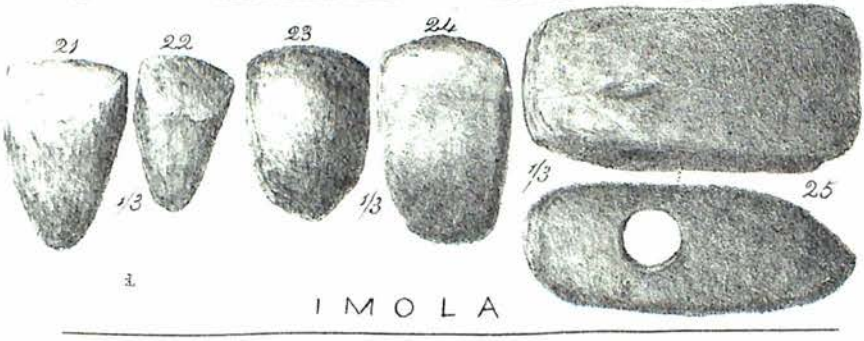
near the Lago di Viverone

IVREA

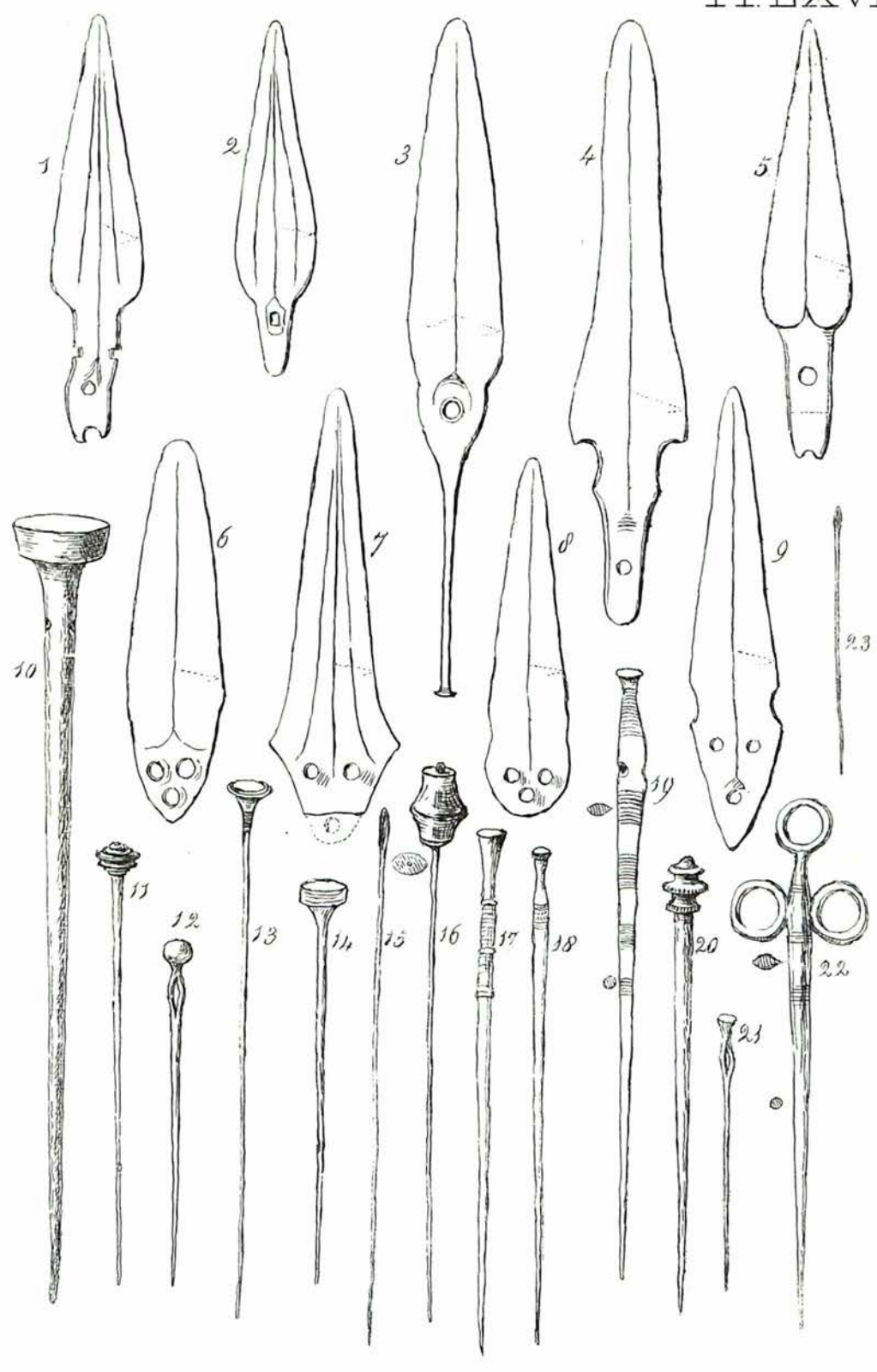


CUMAROLA near MODENA

SESTO CALENDE

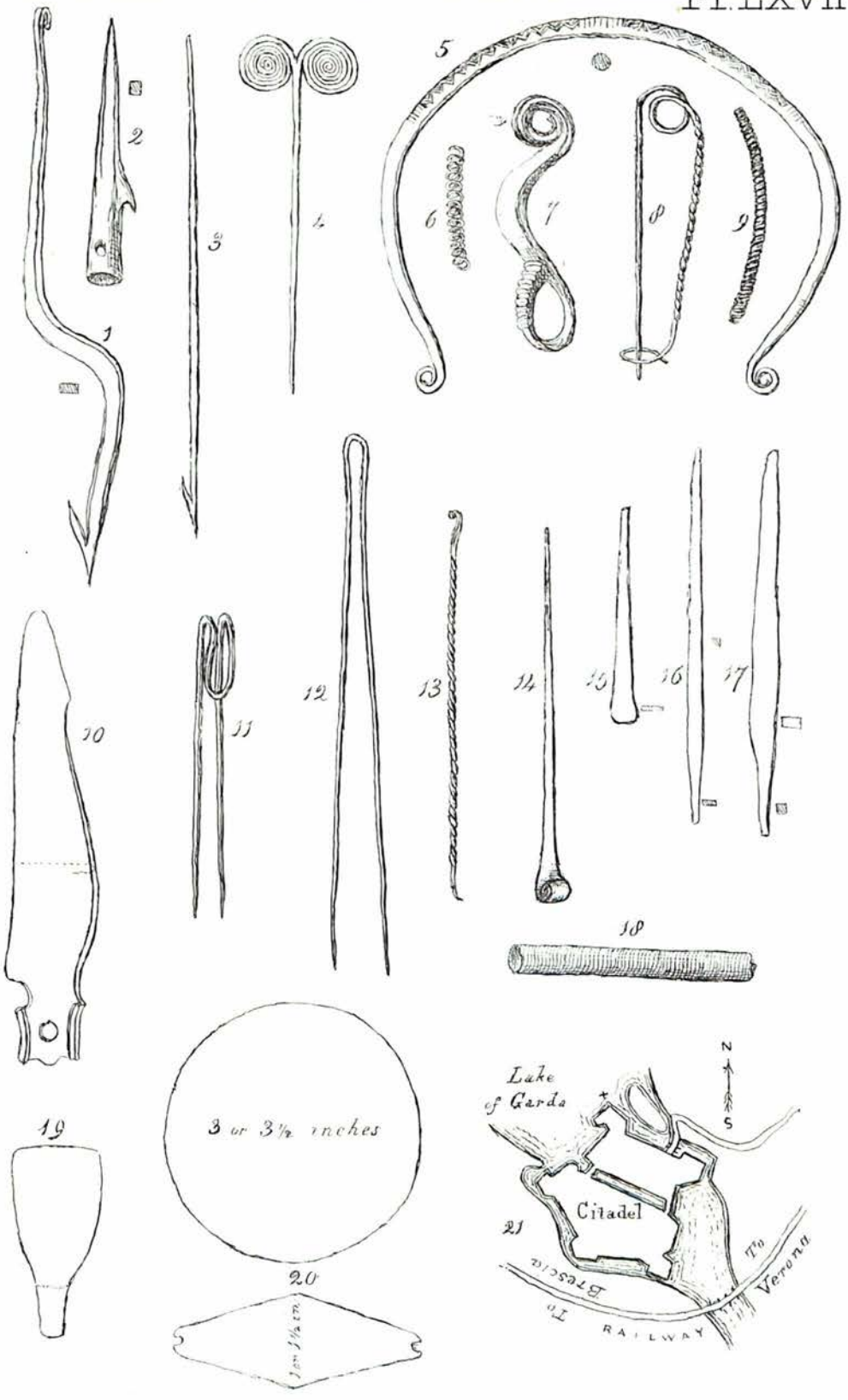


IMOLA



PESCHIERA *Bronze.*

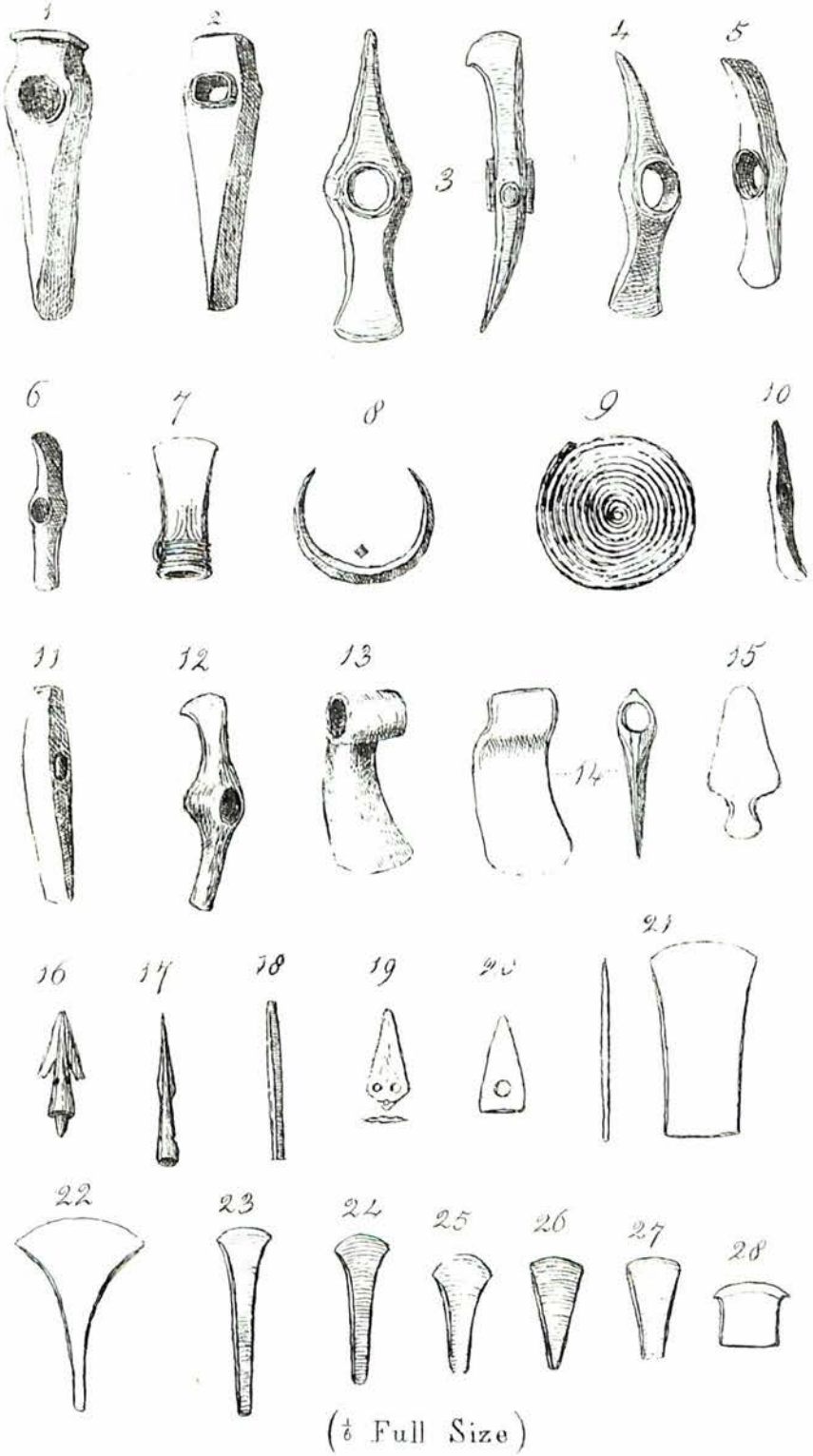
ALL HALF SIZE.



PESCHIERA.

Bronze, Copper Stone. Fig. 1 to 20 half Size.

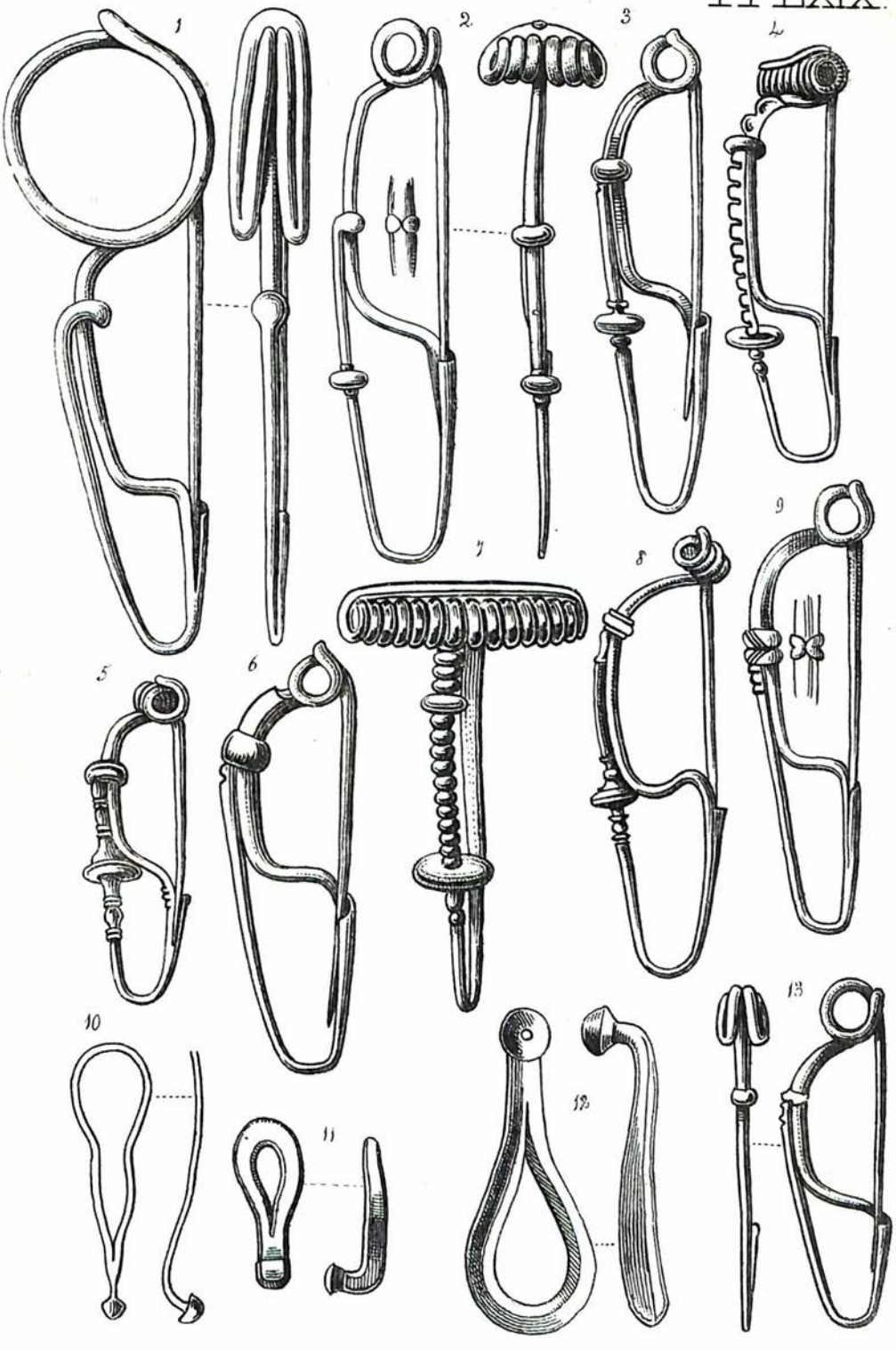
FOR COMPARISON.



(⅙ Full Size)

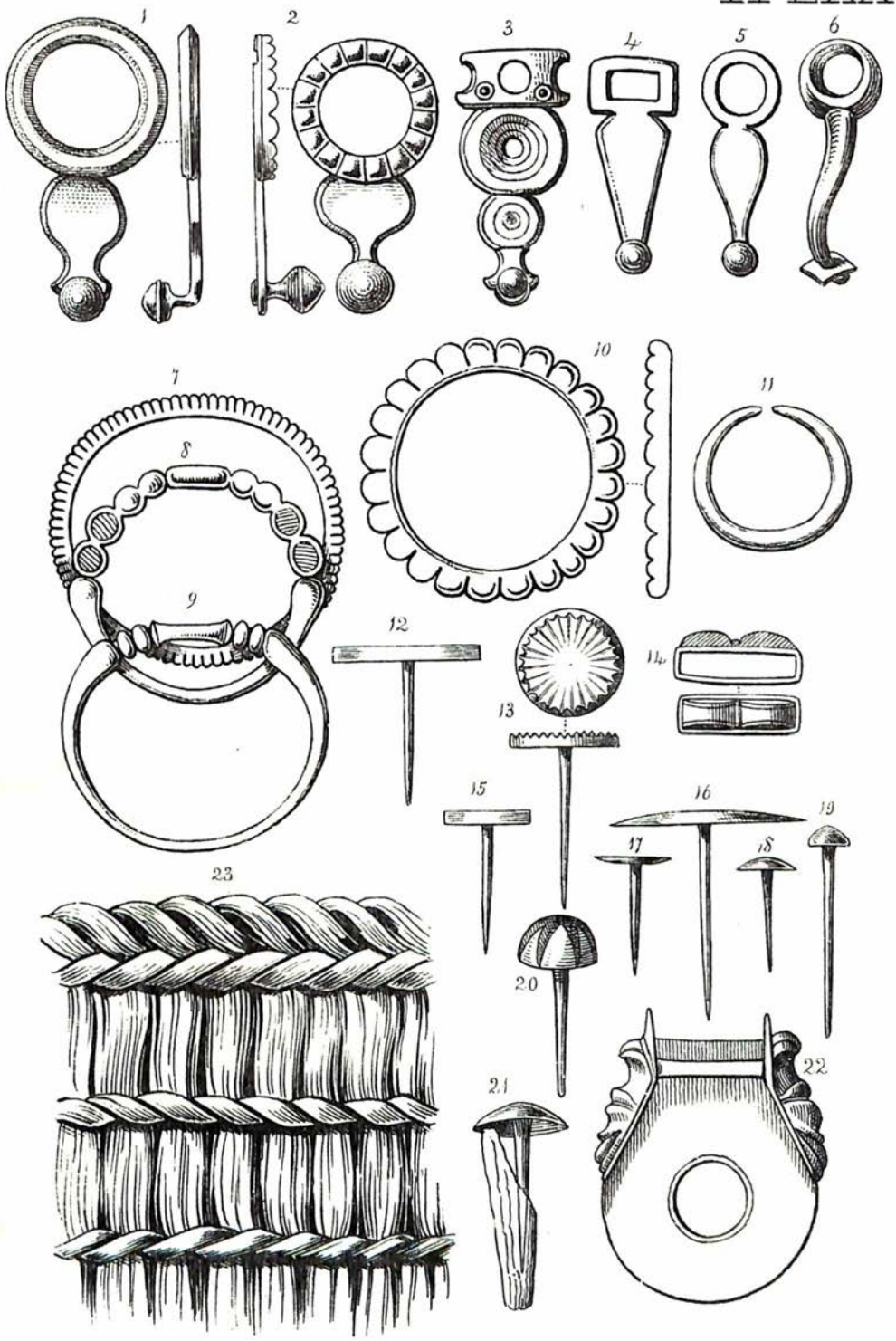
IMPLEMENTS OF COPPER FROM HUNGARY.

MAINLAND.



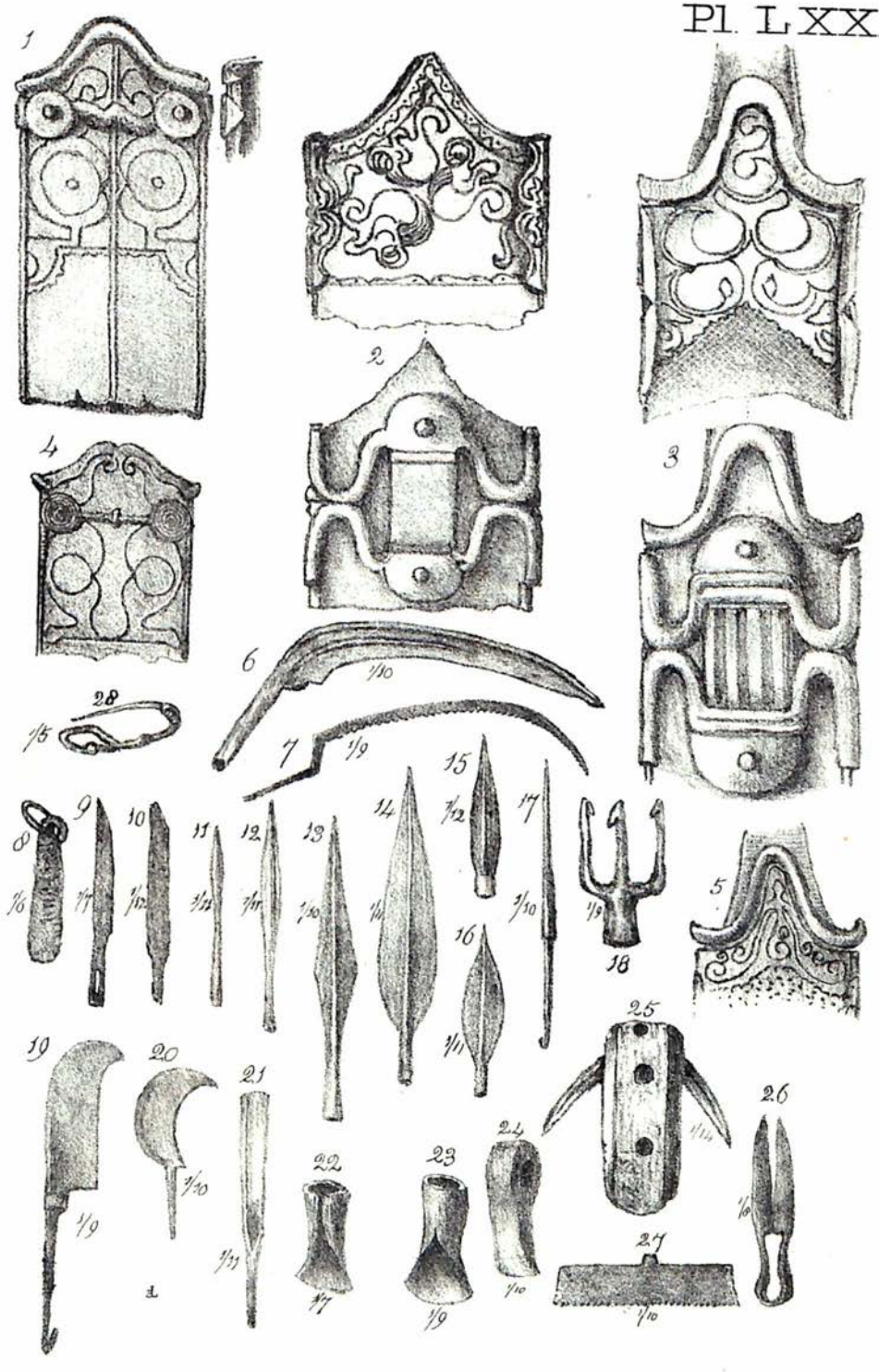
MARIN - *Iron.*

⅔ full Size.



MARIN.

Fig 22 Full size–Rem. ⅔ size.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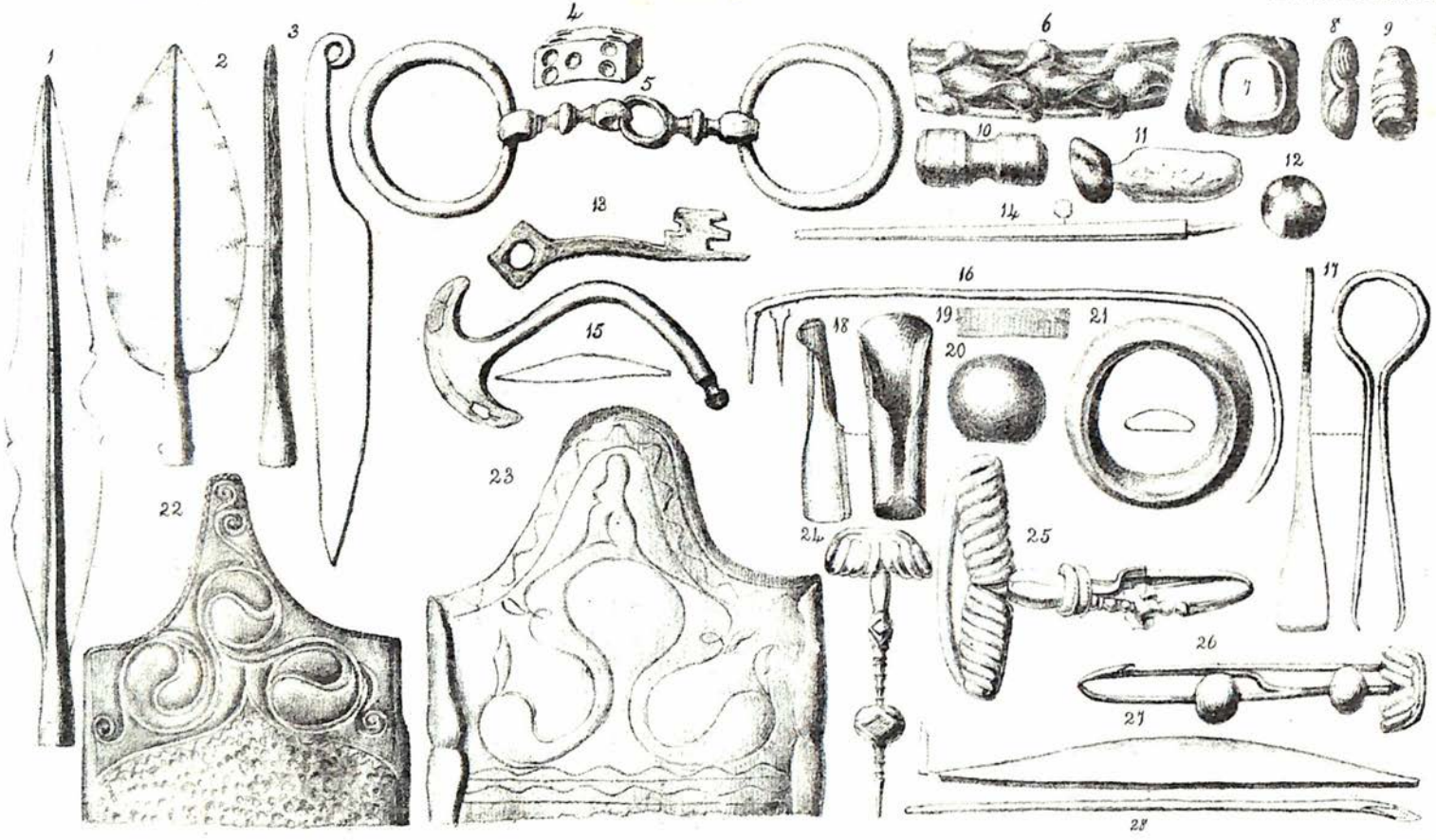
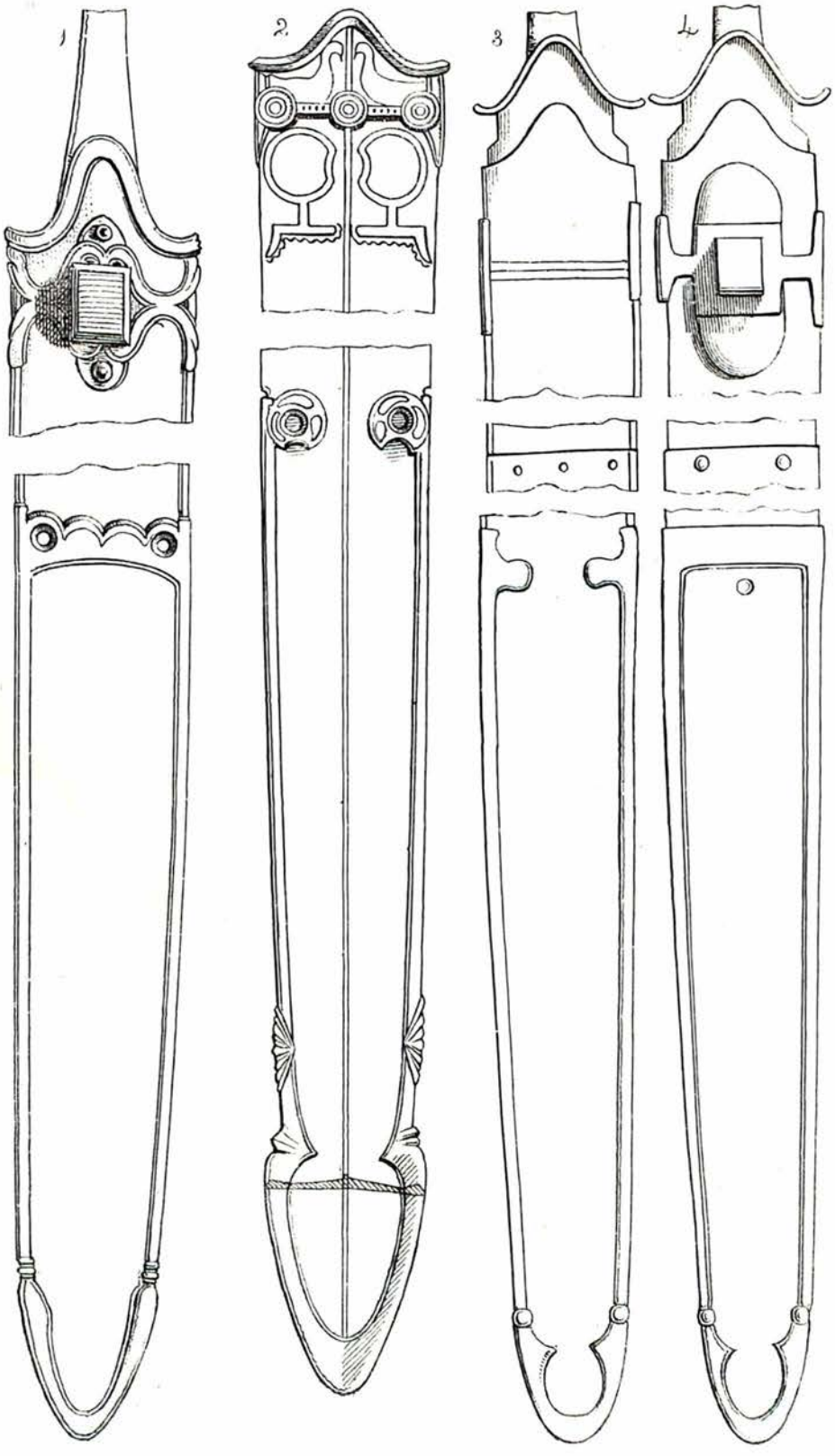
MARIN



MARIN &c.



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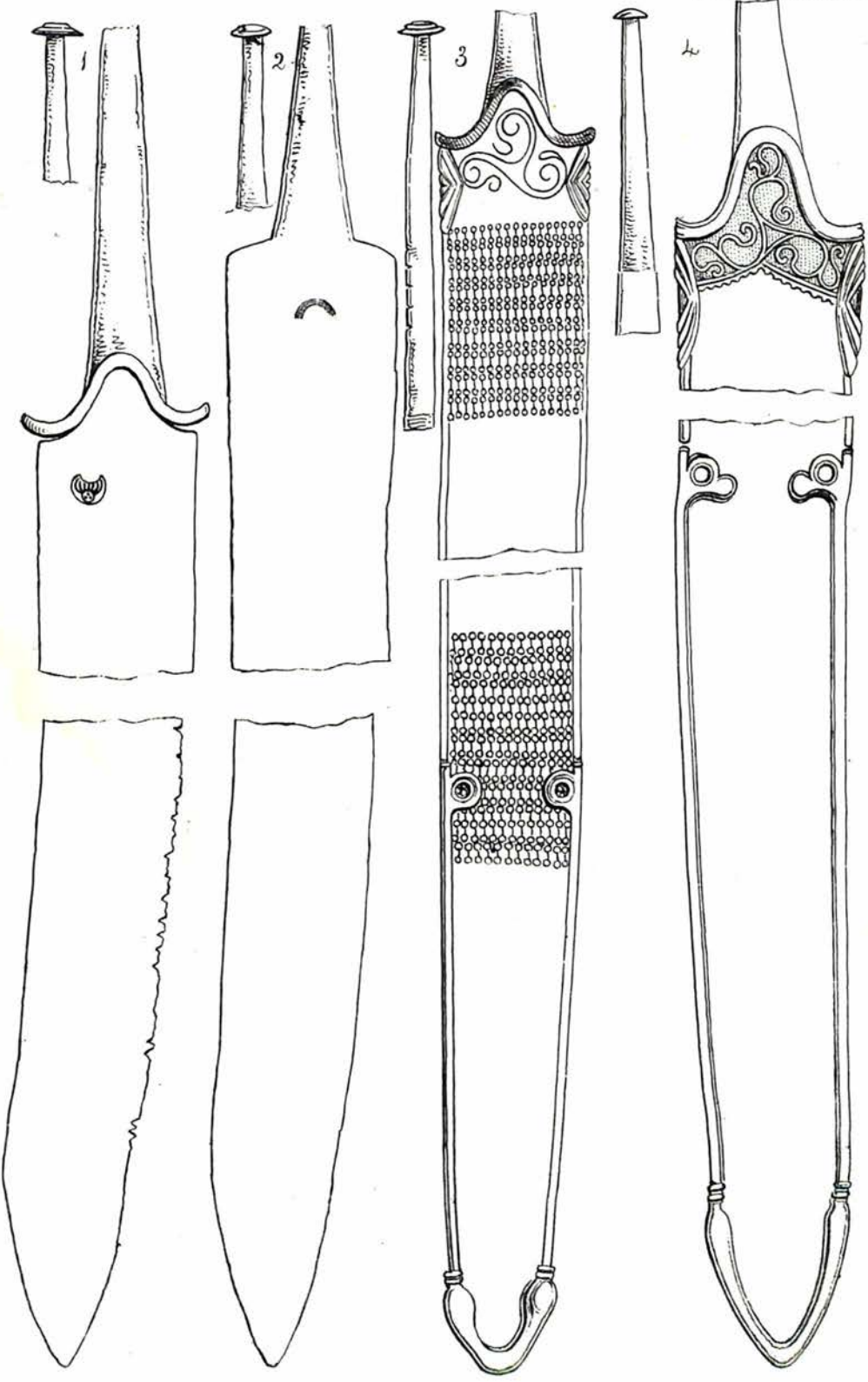
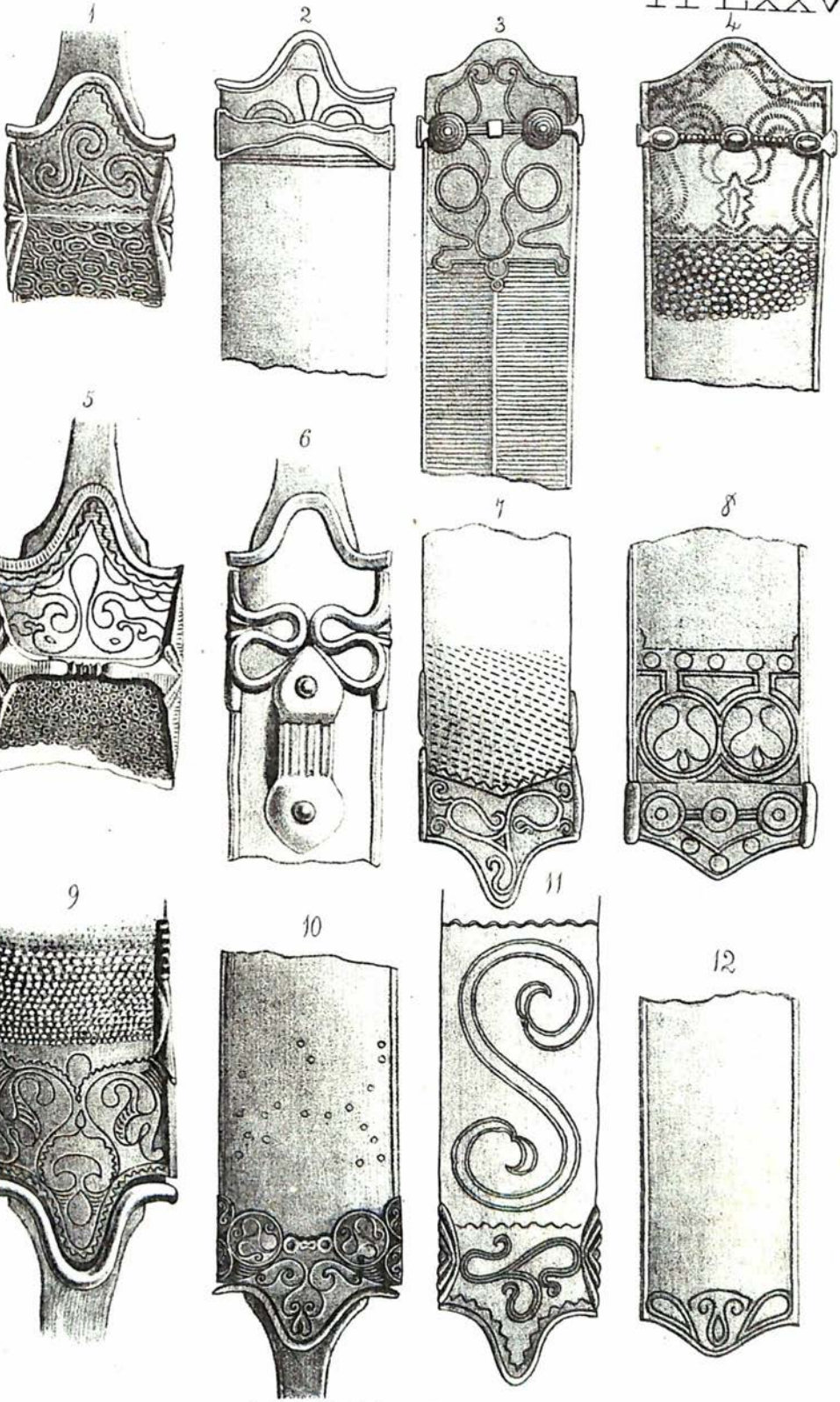
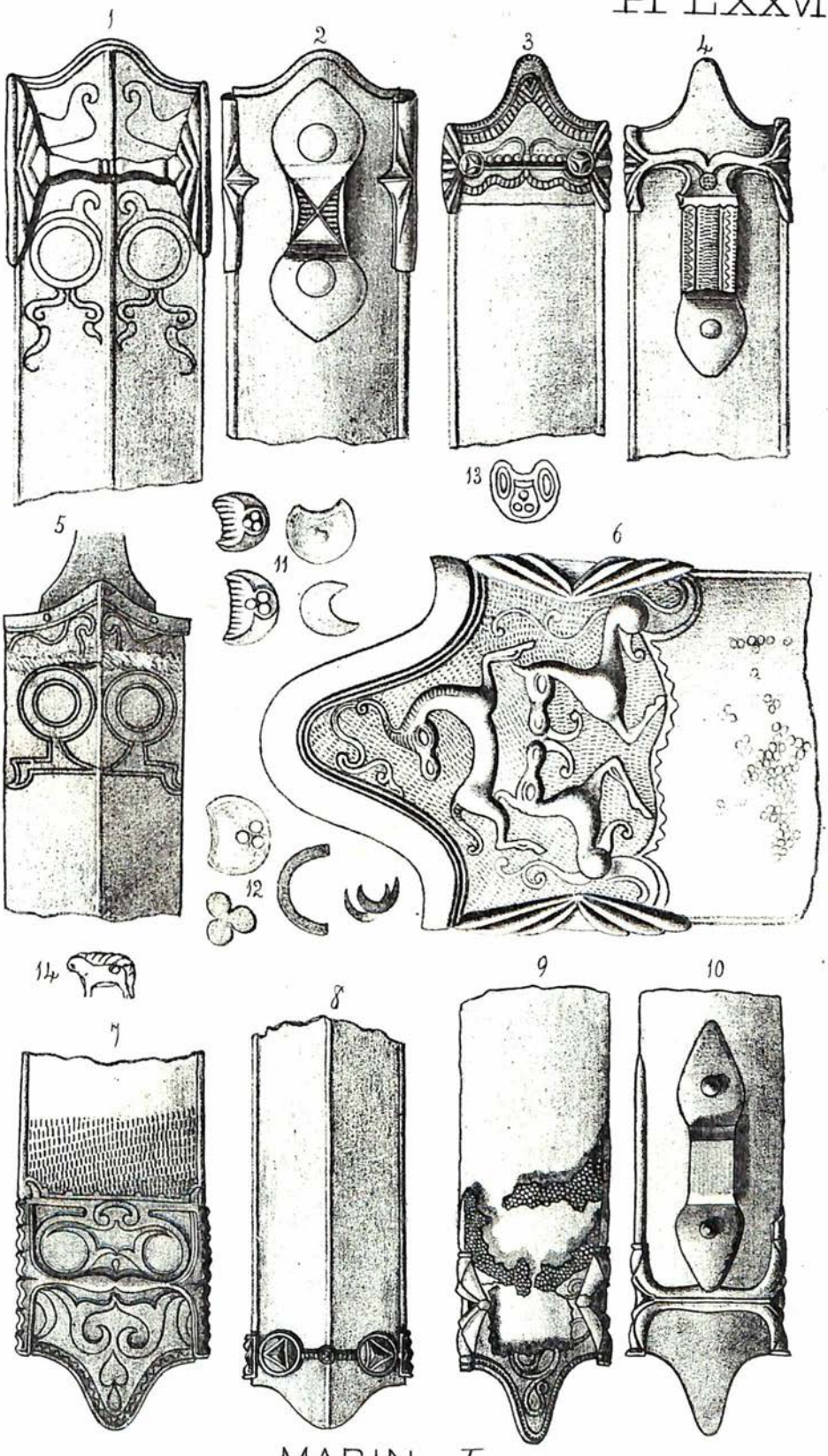


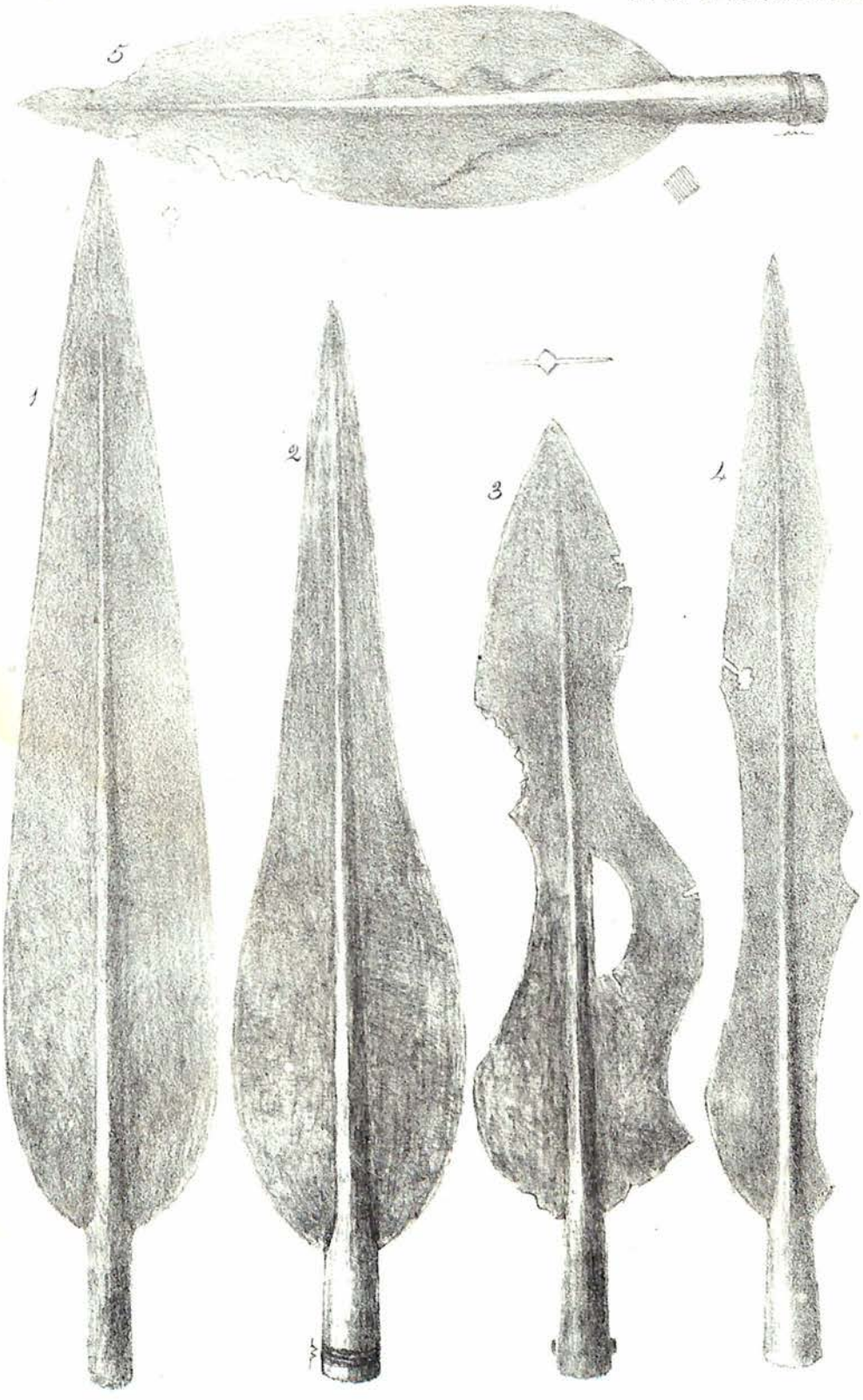
MARIN-*Iron*



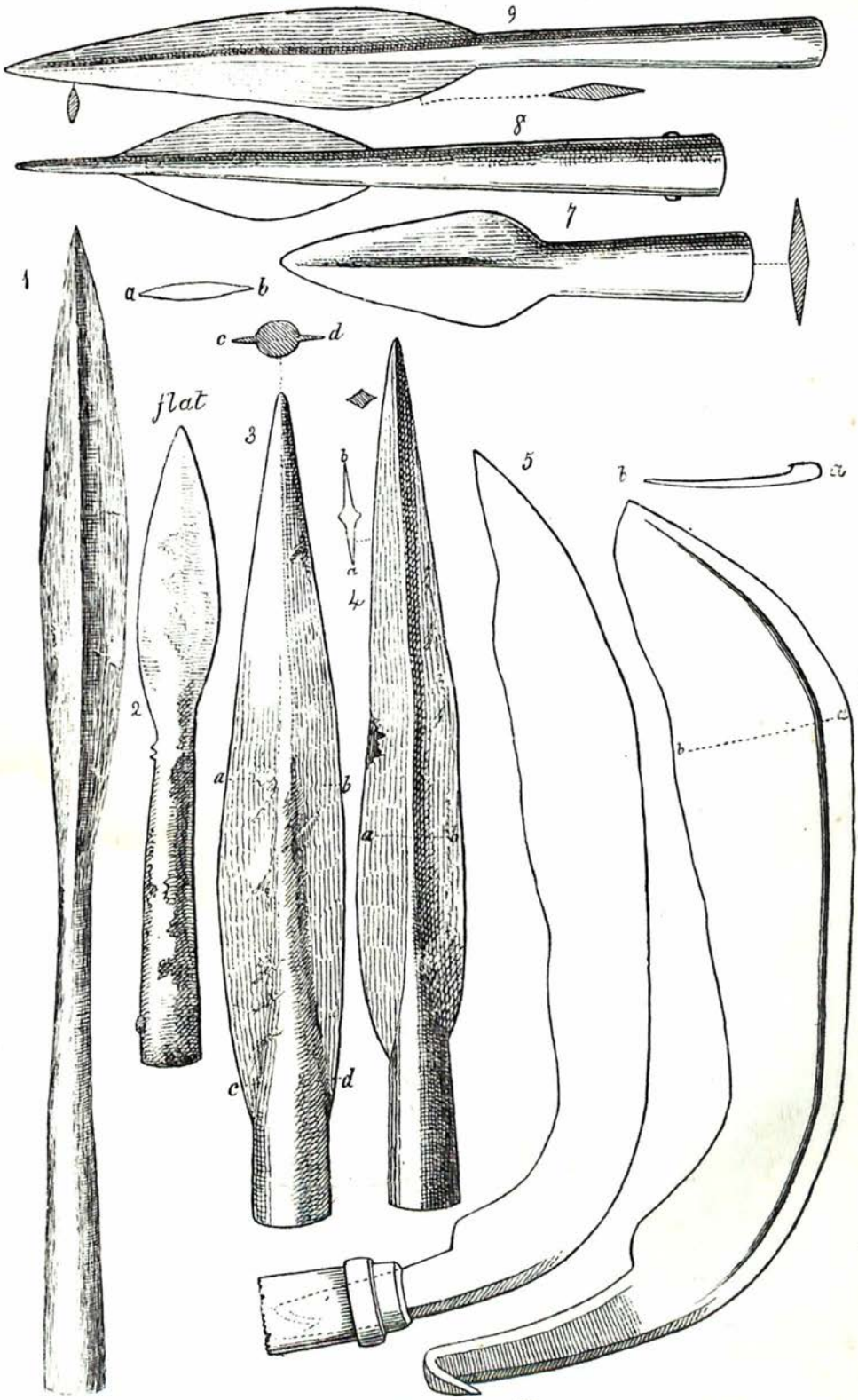
MARIN *Iron.*



MARIN *Iron*

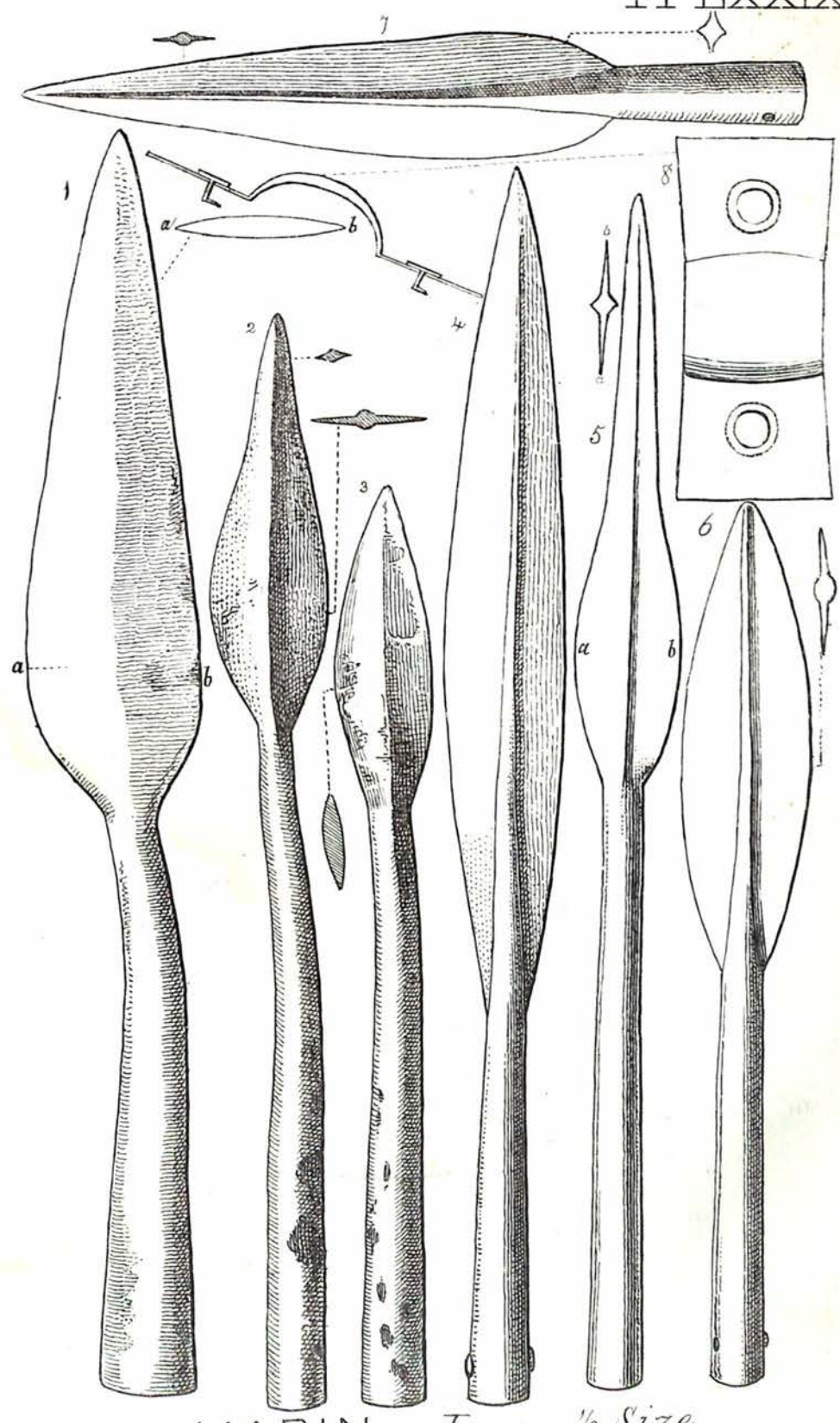


MARIN.—*Iron all ⅜ full size.*

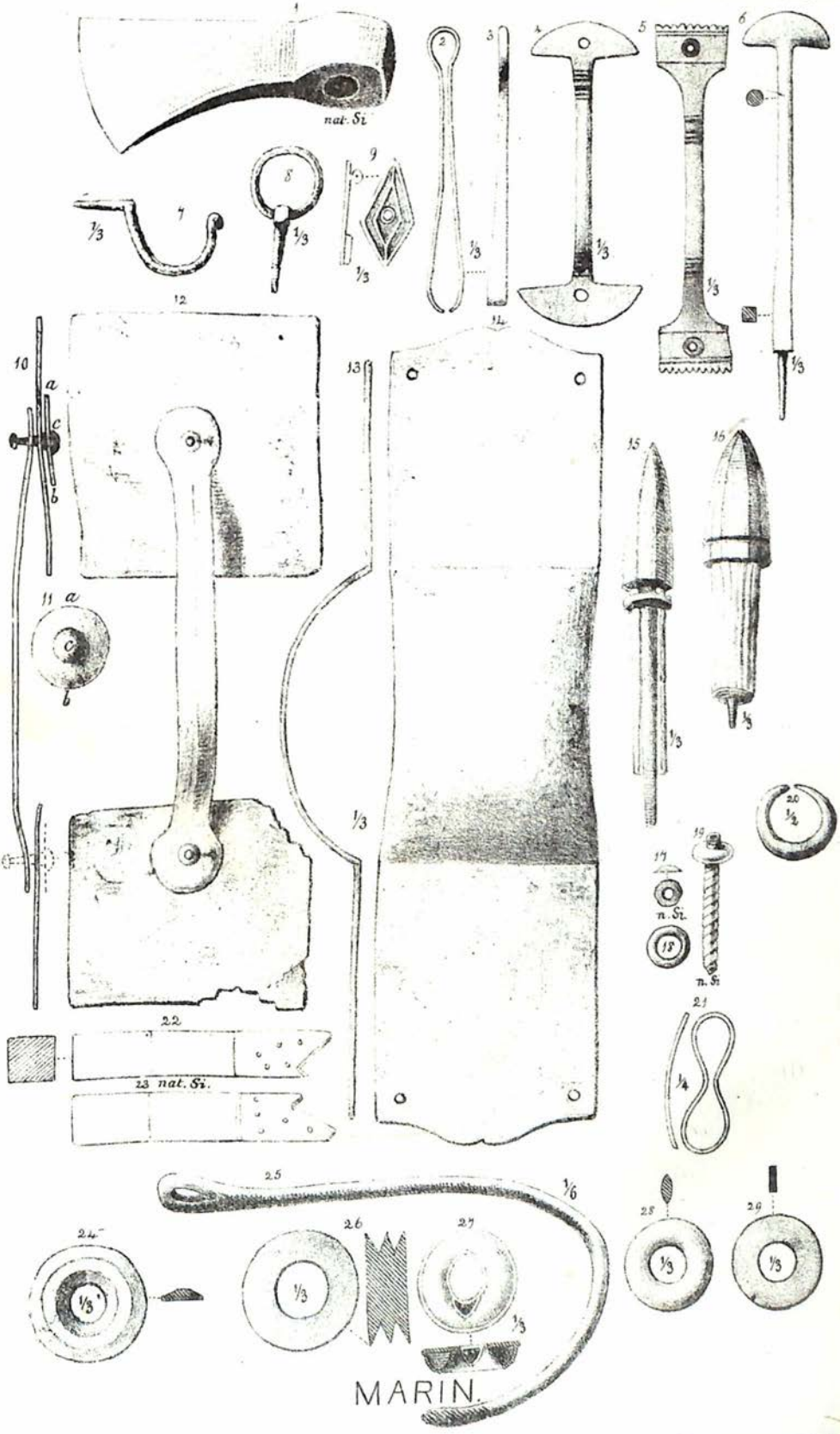


MARIN — *Iron.*

Fig 1 ⅛ 5 & 6 ⅛ Remr ½ full Size.



MARIN *Iron. ½ Size.*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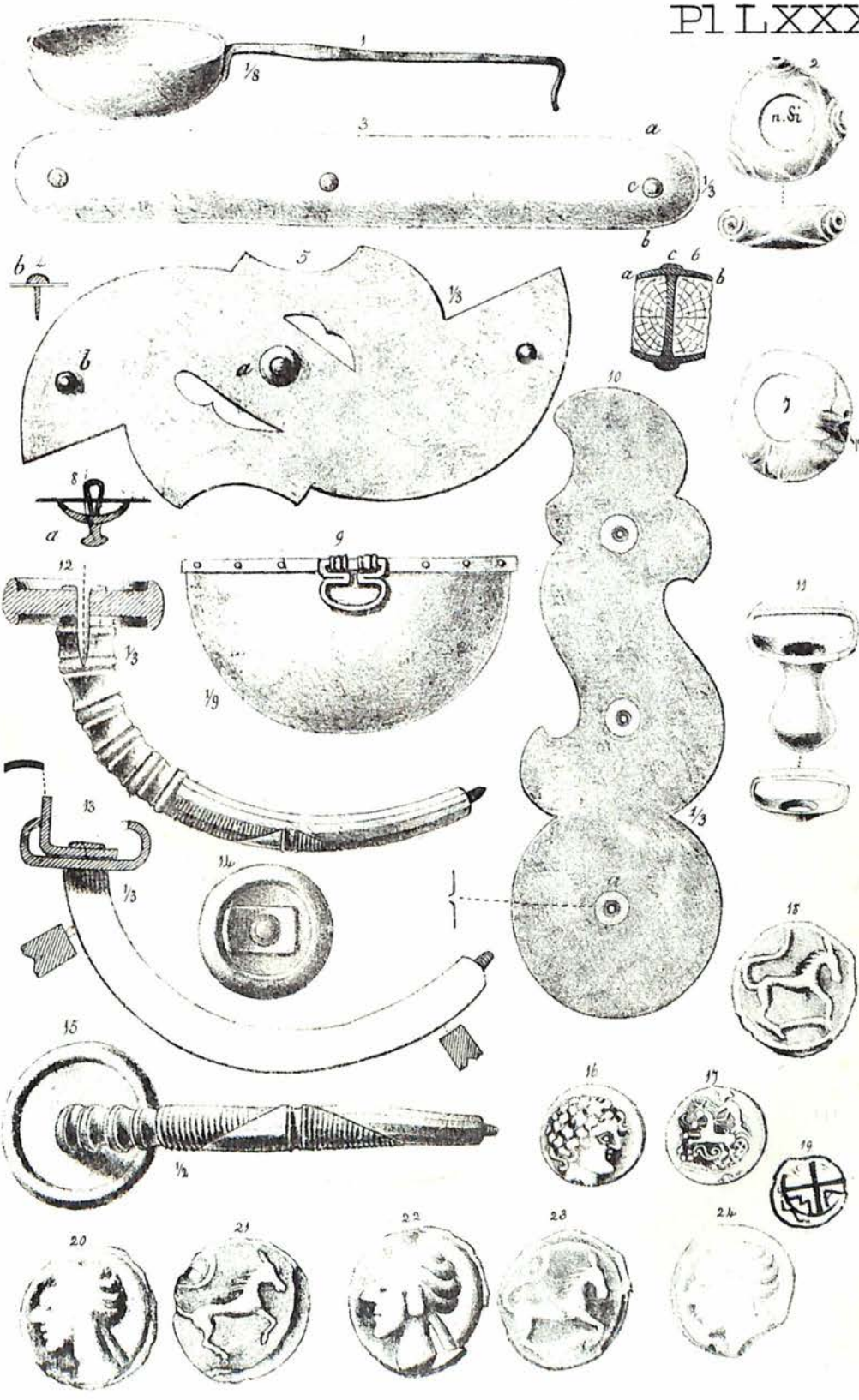
nat. Si.
MARIN.

Pl LXXXI



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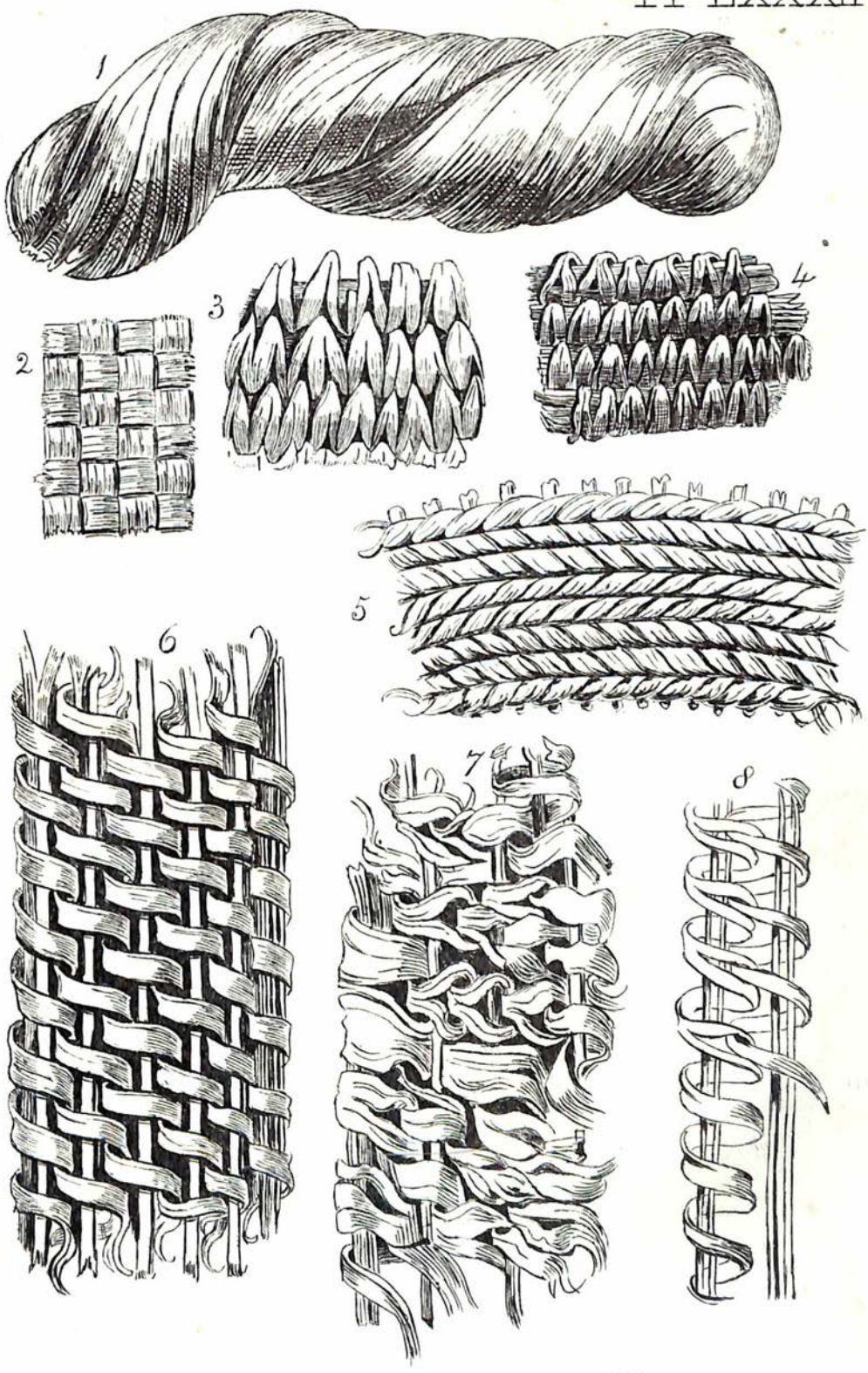
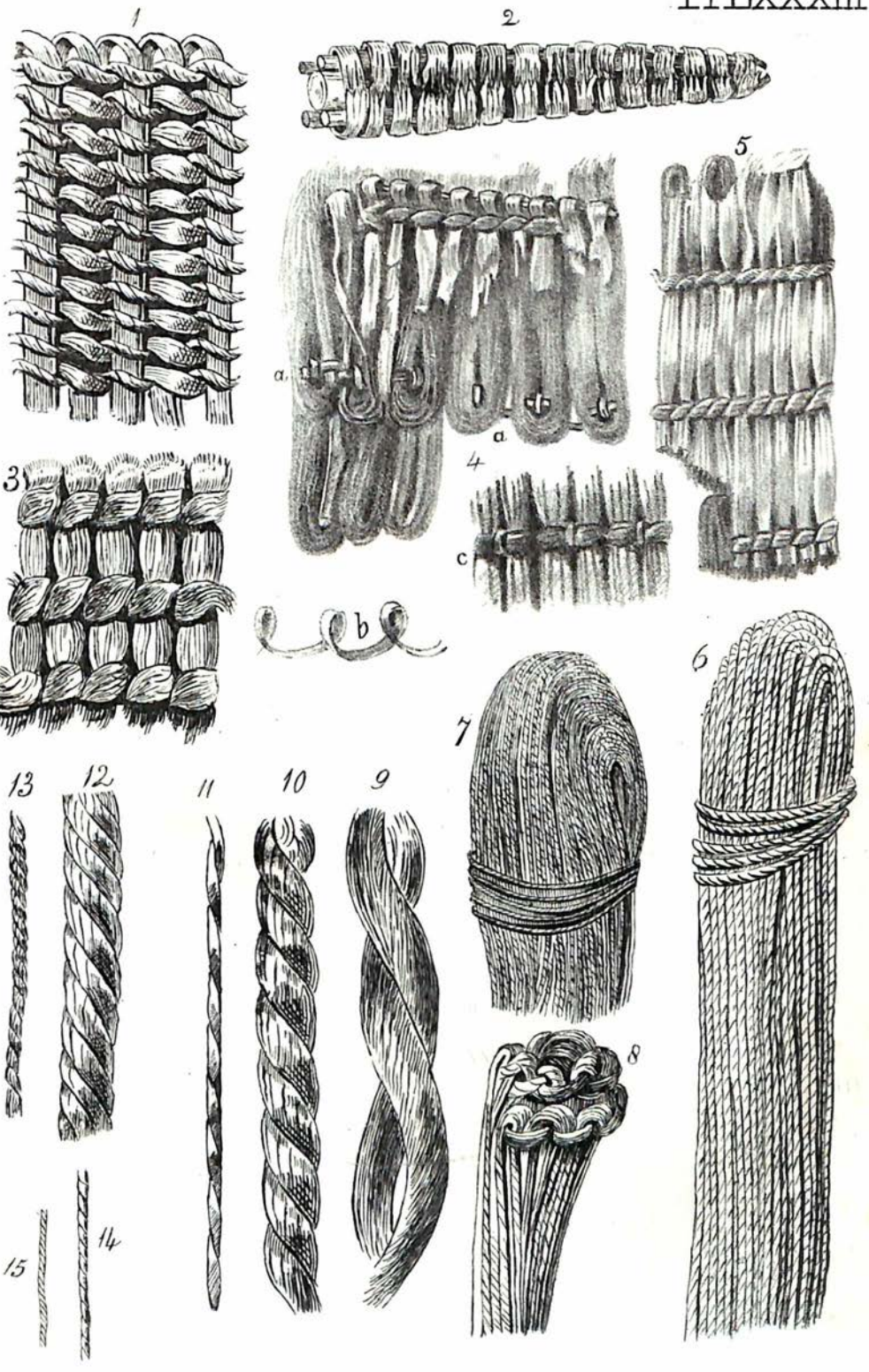


ROBENHAUSEN & WANGEN.

Bast &c



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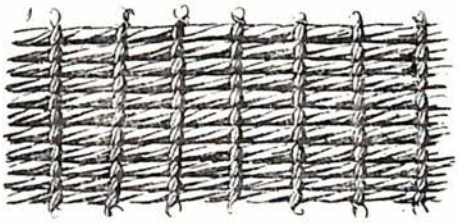
Bast & Flax.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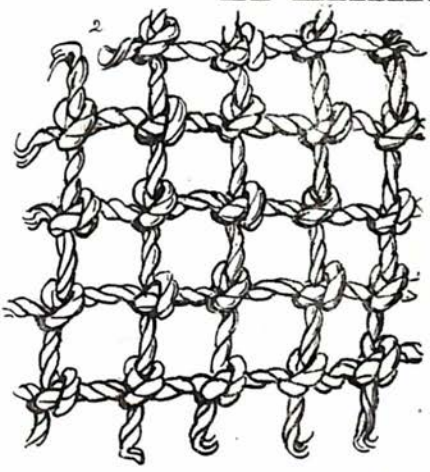
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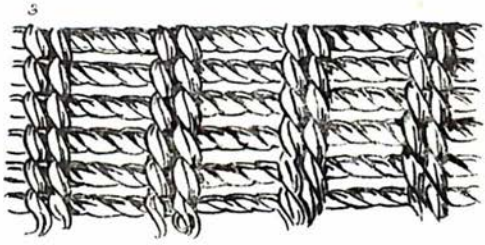
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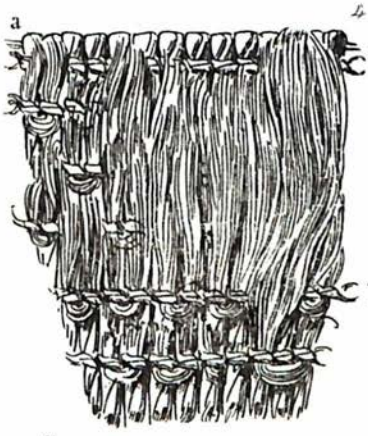
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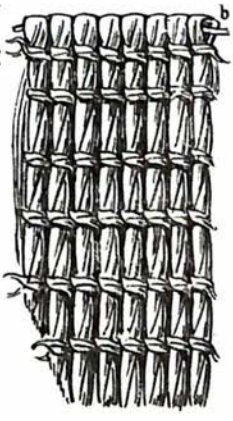
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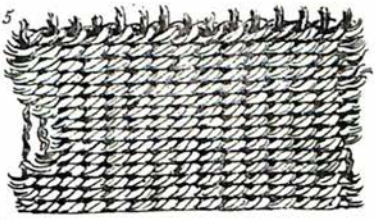
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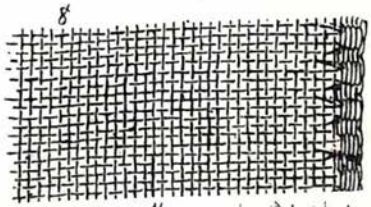
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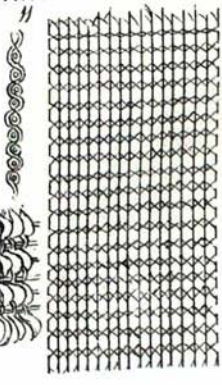
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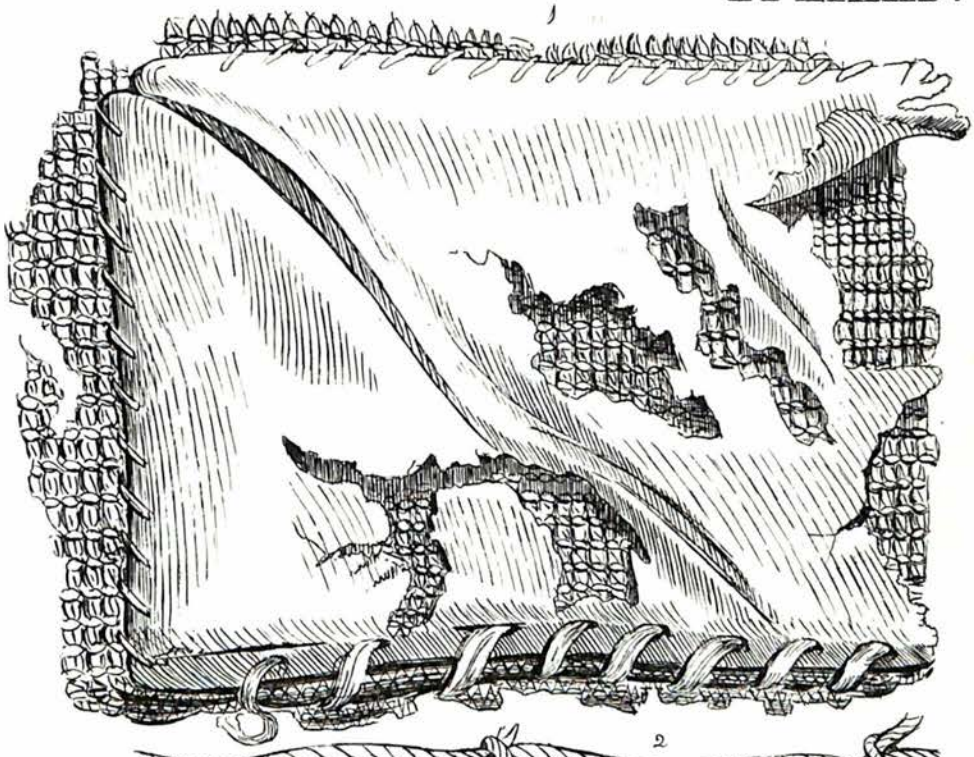

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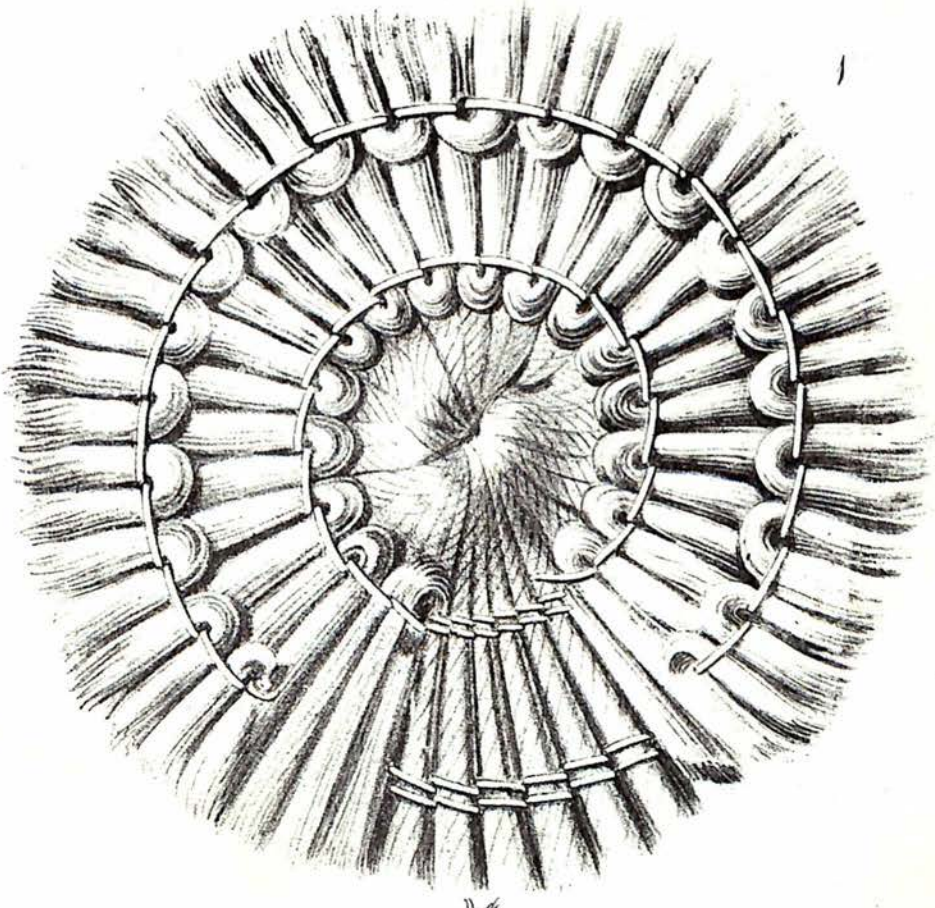

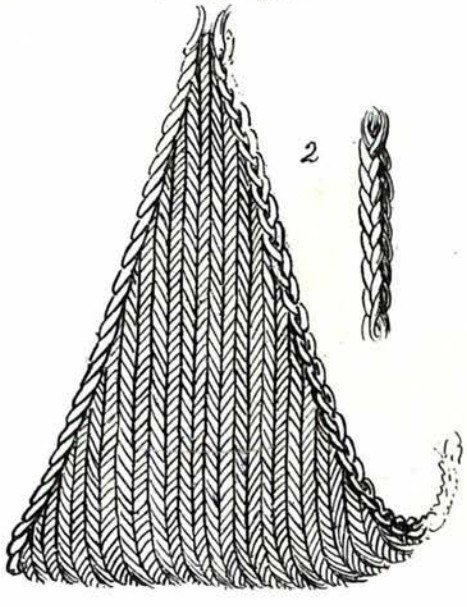

WANGEN & CORTAILLOD.

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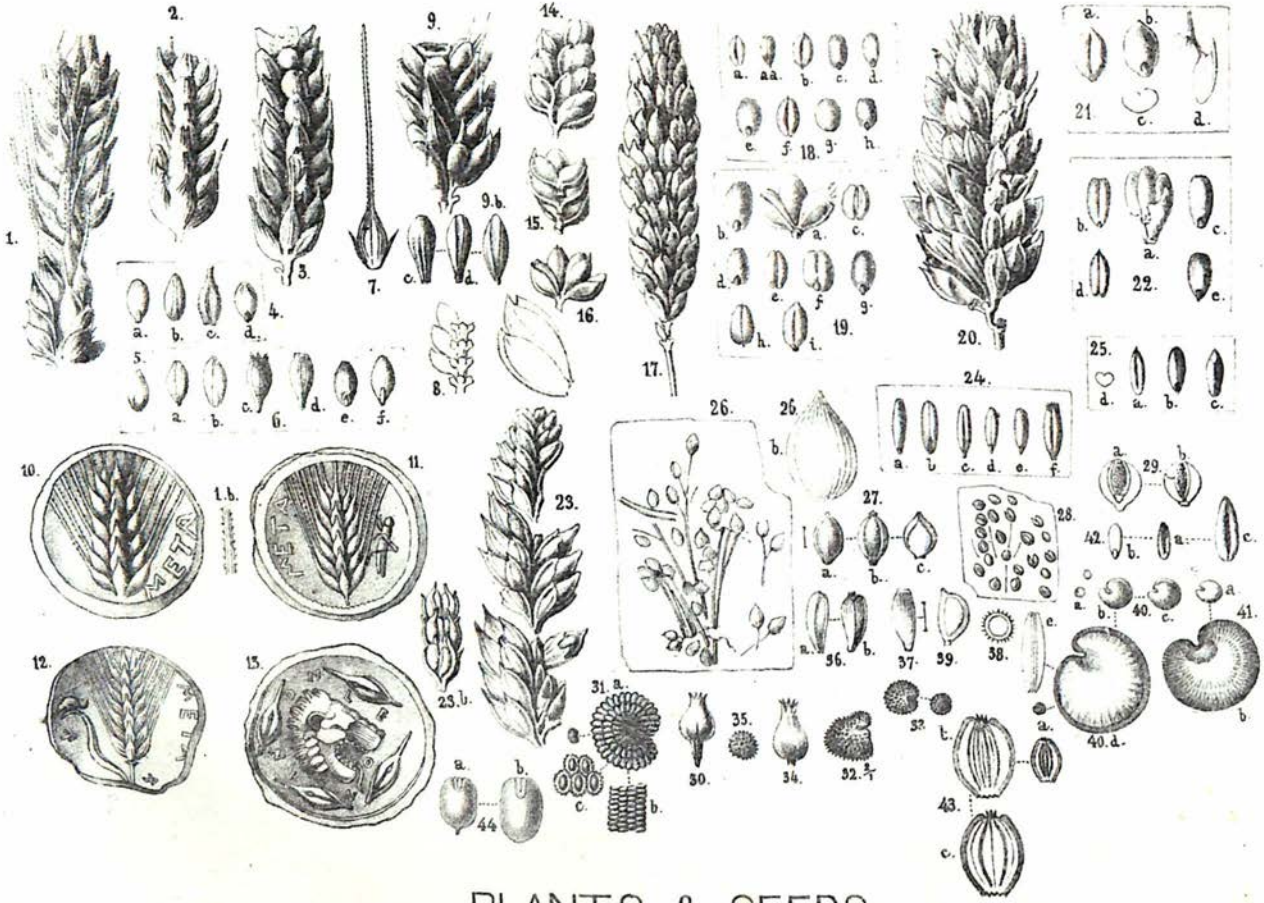
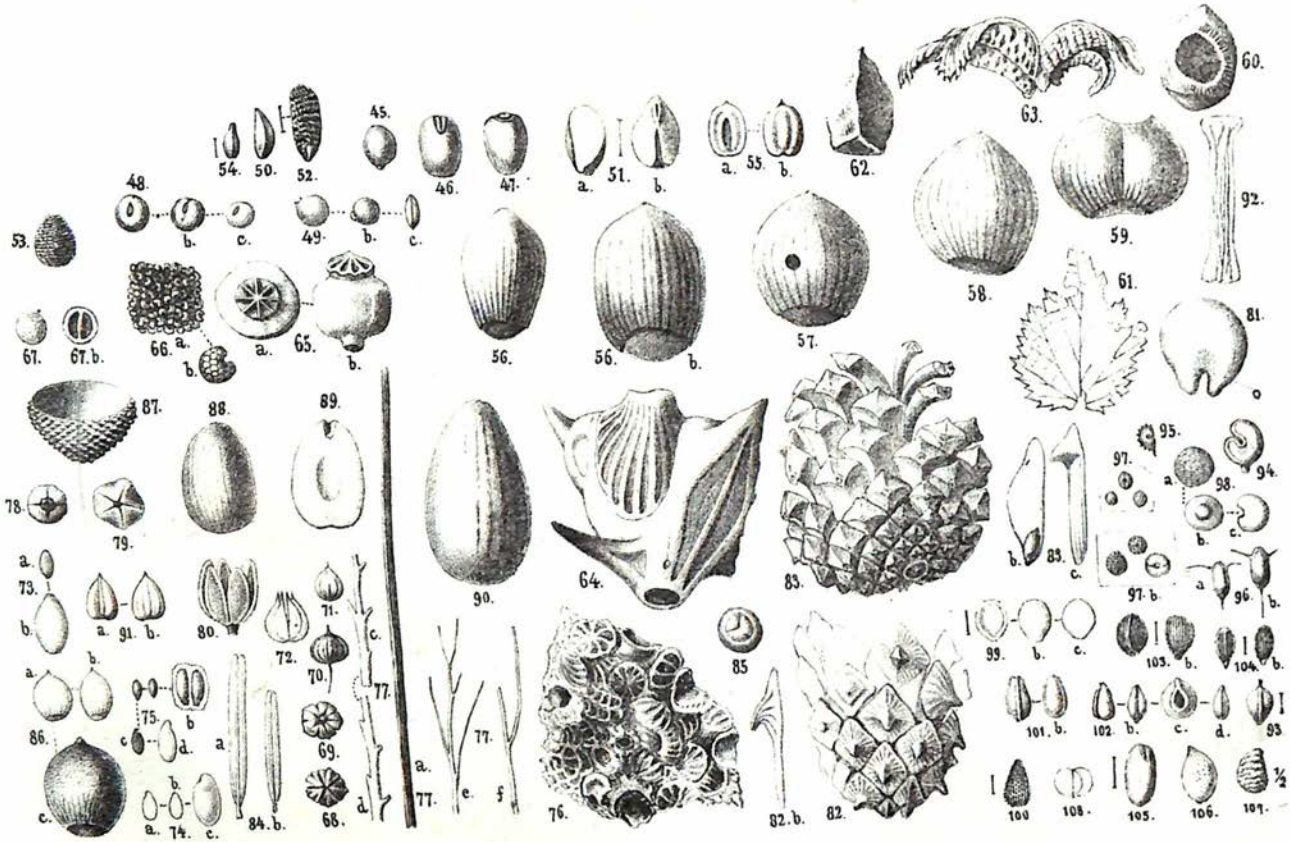


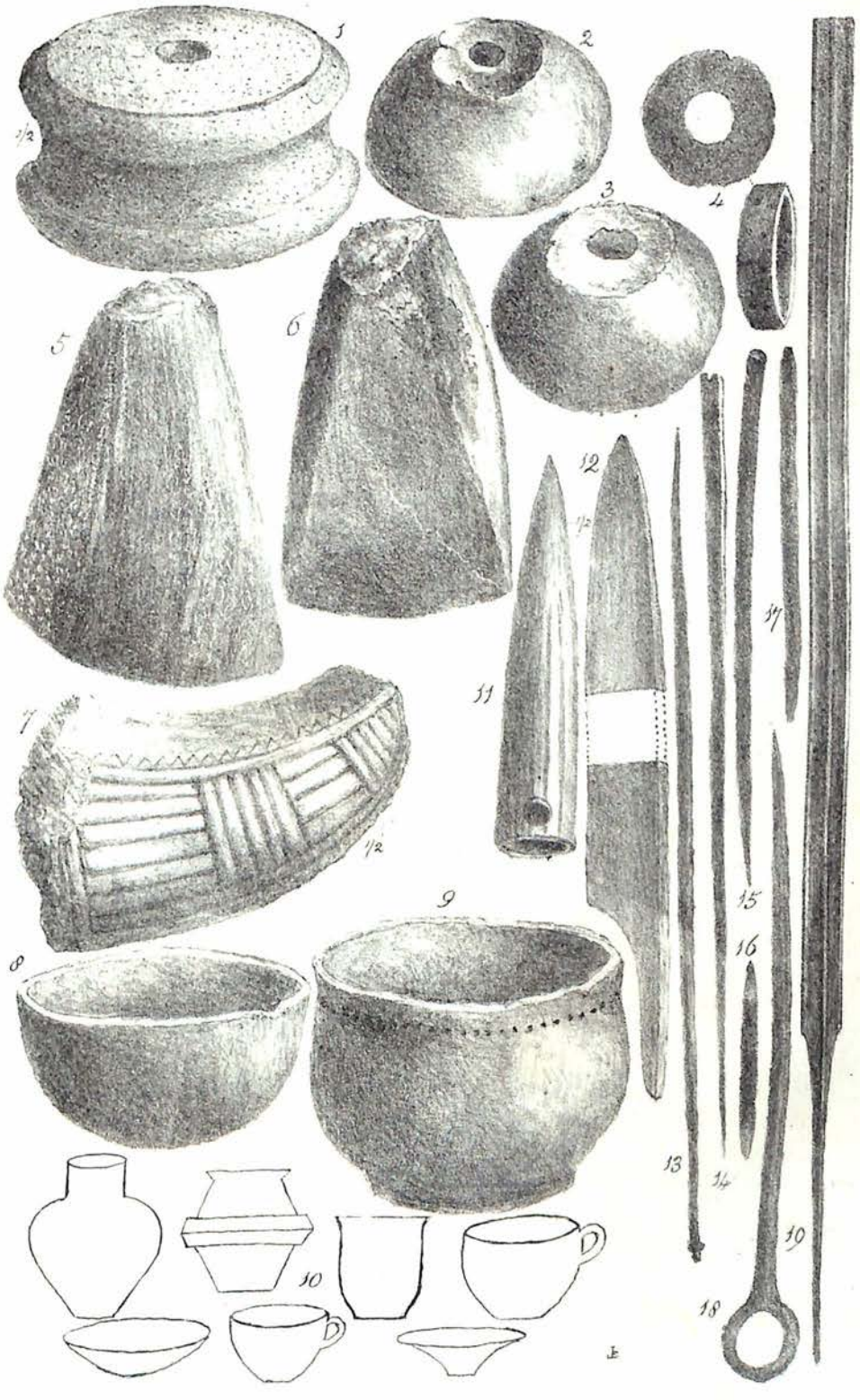
PLANTS & SEEDS.



PLANTS & SEEDS.

Pl LXXXIX

FOR COMPARISON MAIN LAND.



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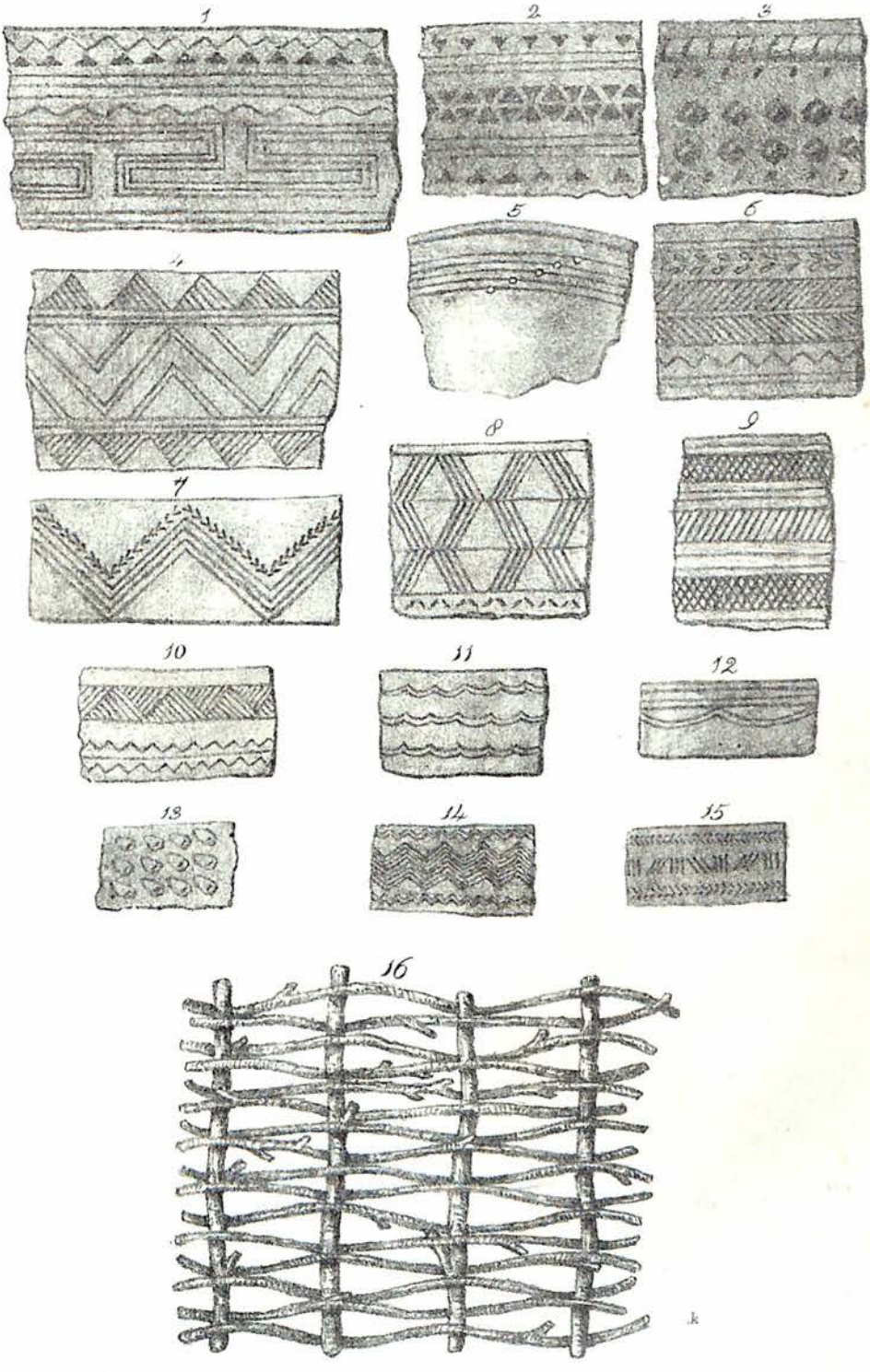
FOR COMPARISON MAIN LAND.



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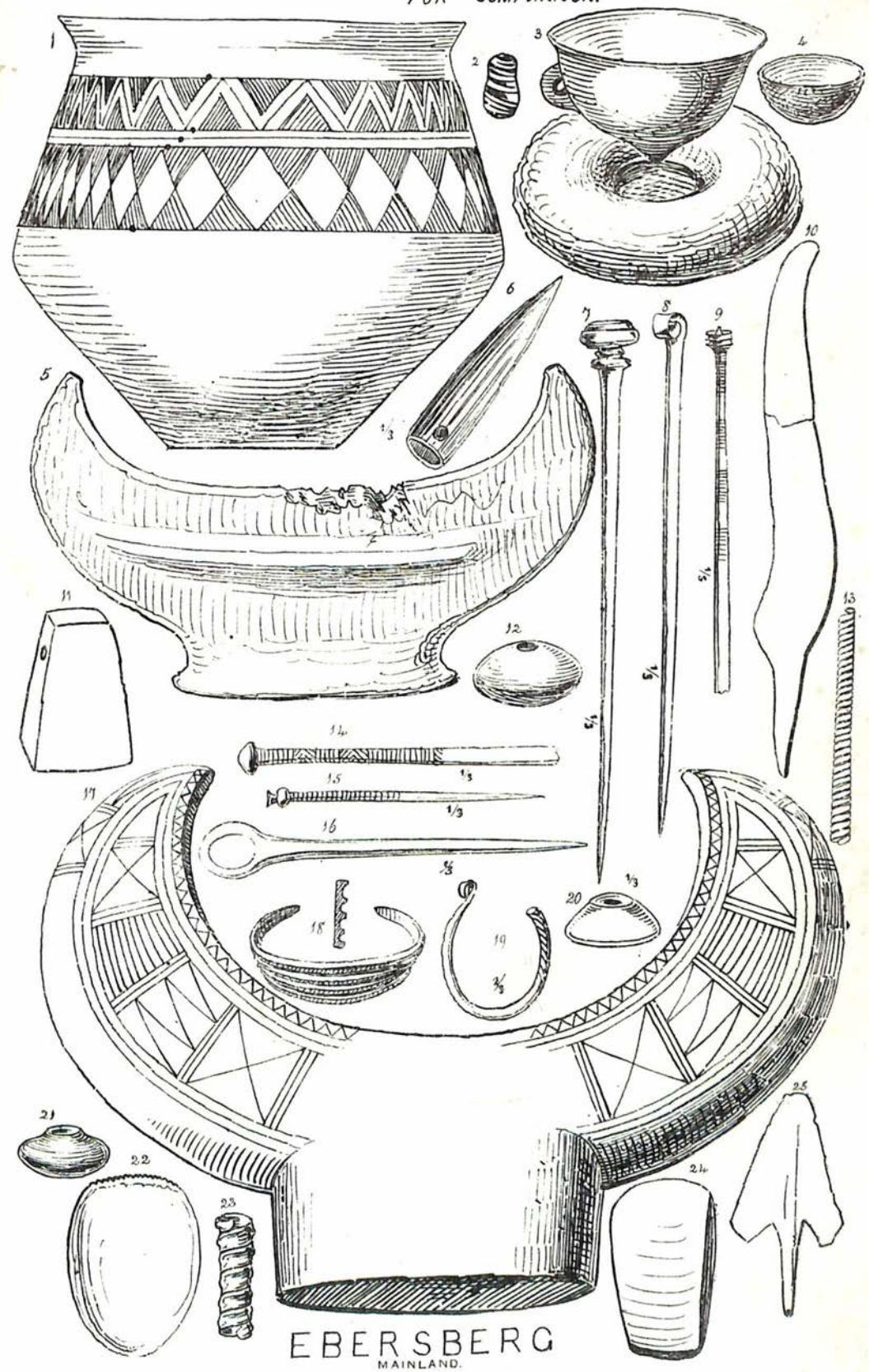

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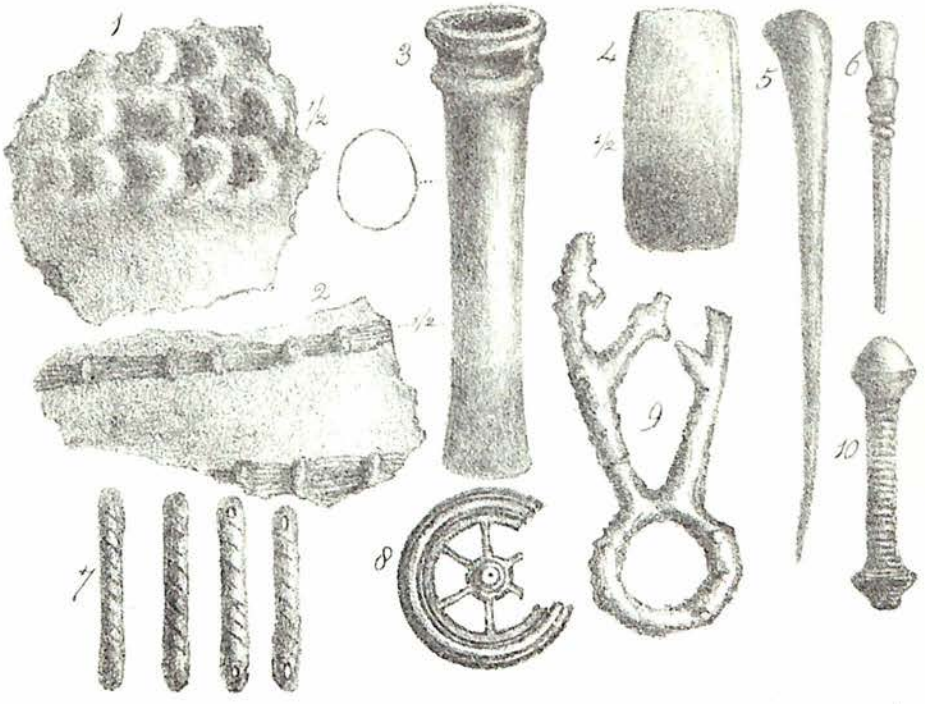
MAINLAND.

FOR COMPARISON. MAIN LAND.



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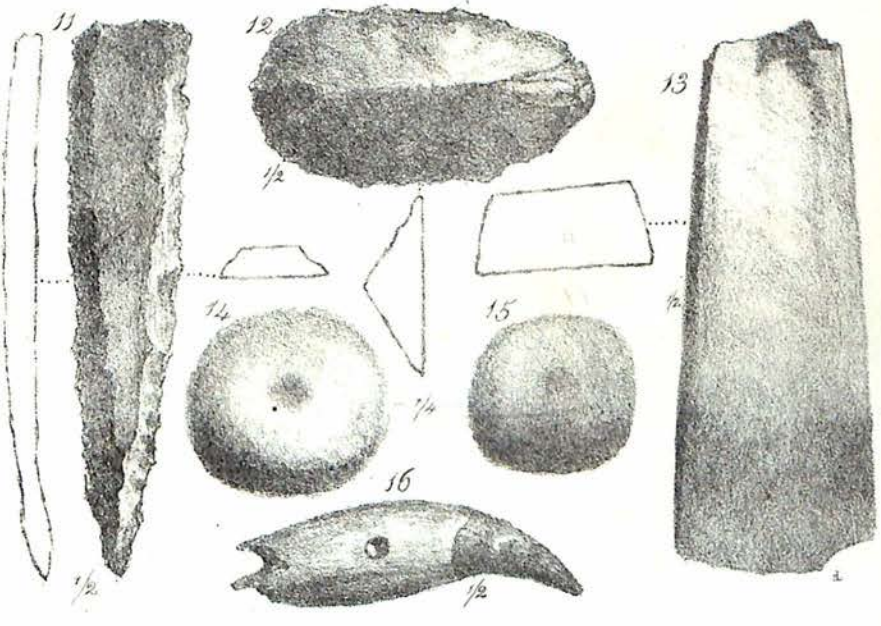

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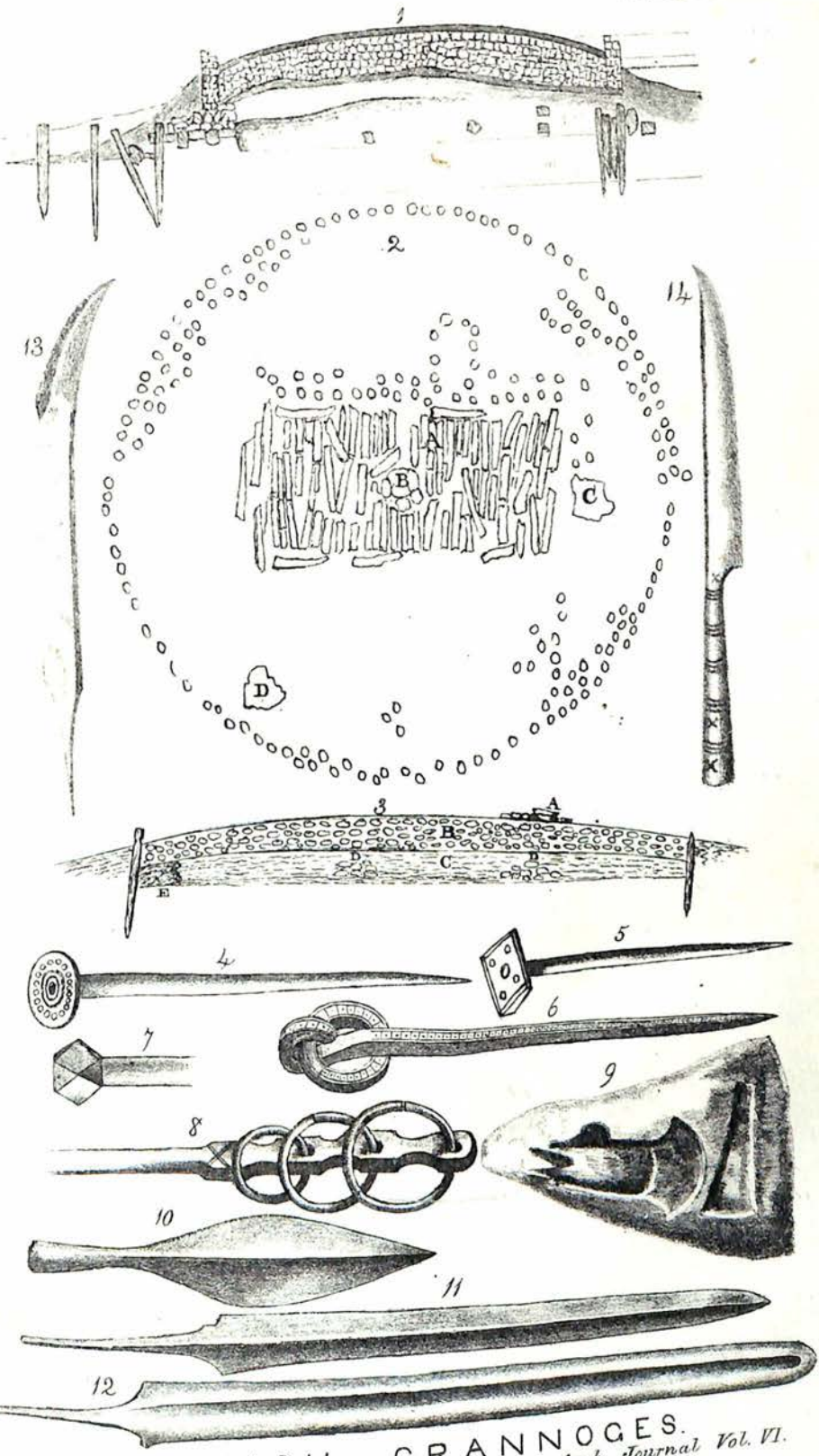
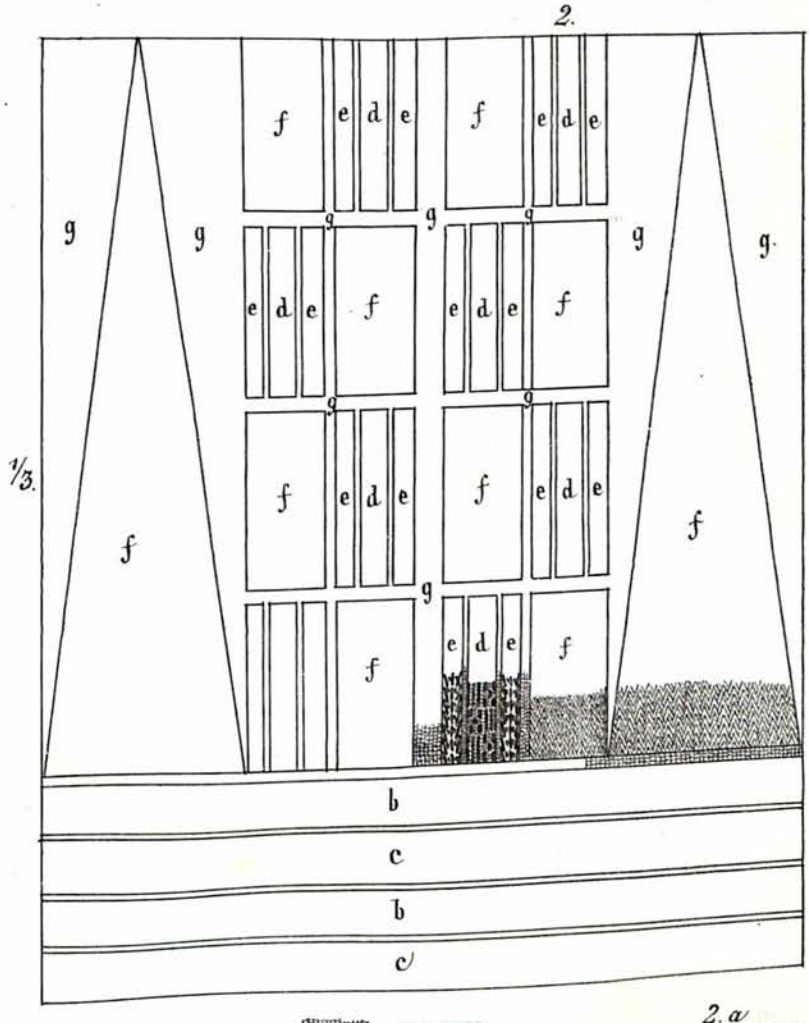
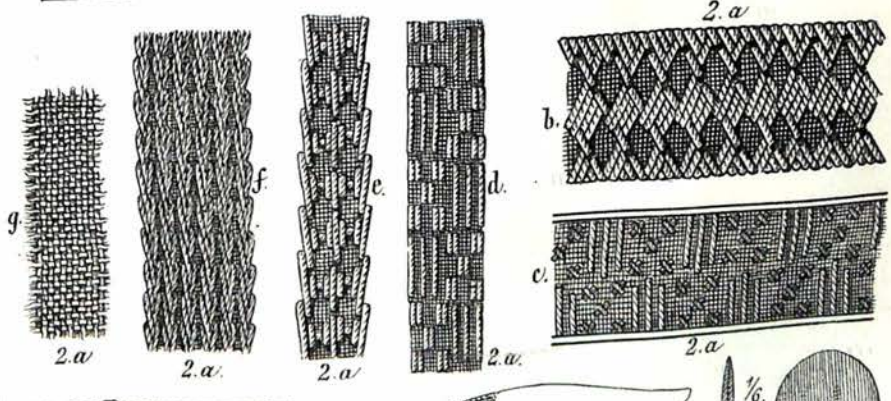
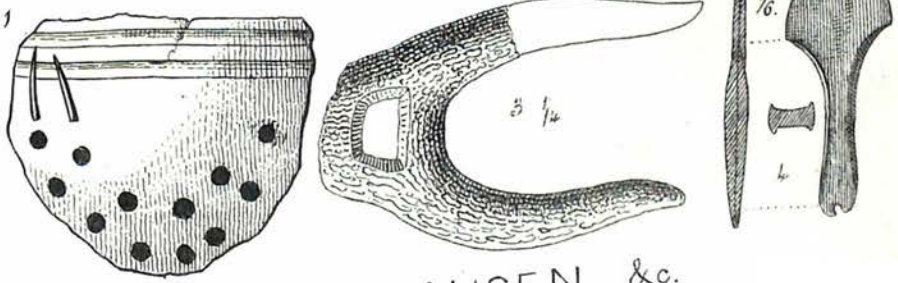


IRISH CRANNOGES.

Copied from Sir W. R. Wilde's Catalogue & Arch. Journal Vol. VI.







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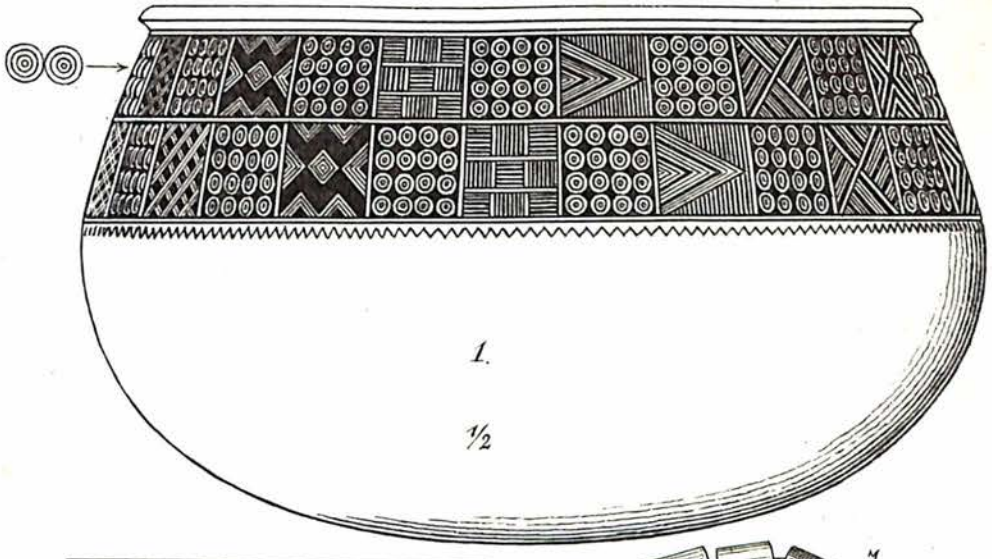
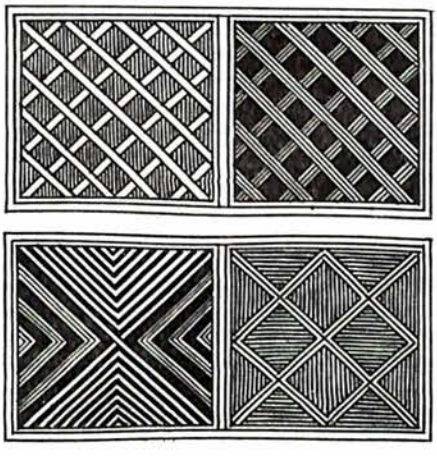
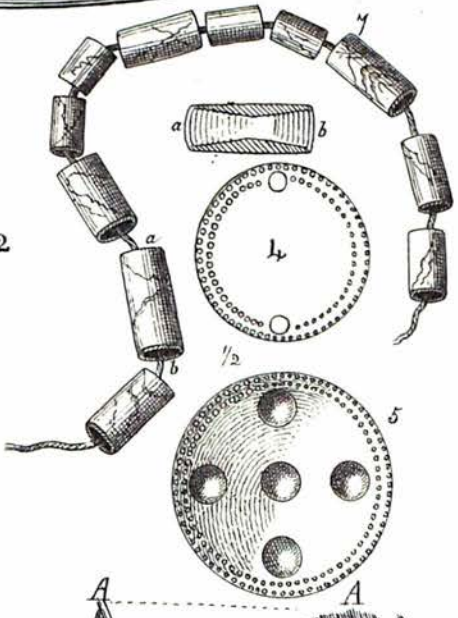
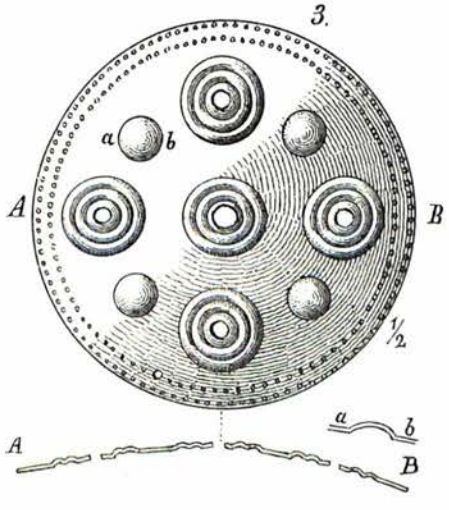
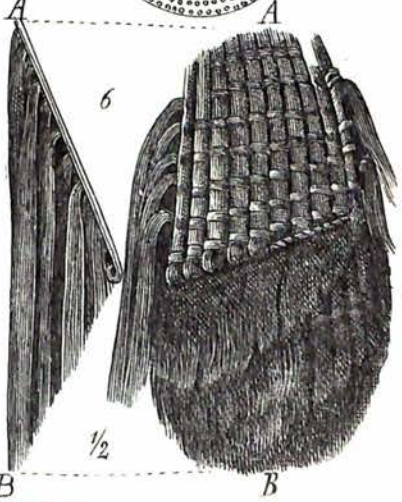


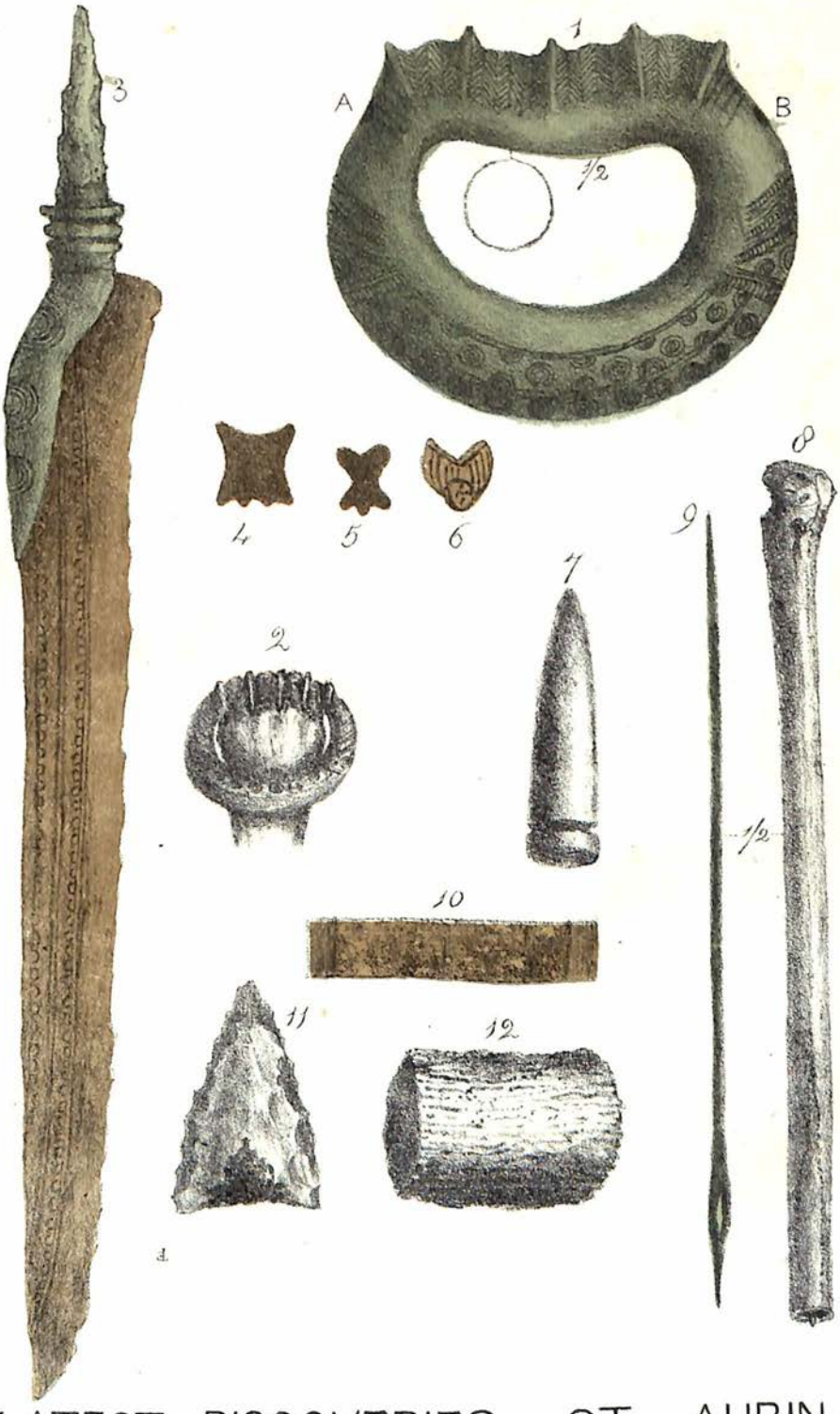








CORTAILLOD &c.



LATEST DISCOVERIES - ST. AUBIN &c.

INDEX.

AA

AA brook, 37
Abulfeda, 316
Age of L. D., 292, 344, 346
Age of Marin ant., 256
Ages of stone, bronze, and iron, 12
Ægeri Lake, 126
A la Sauge, 283
A la Tène, 239, 279
Alise, ant. of, 247
Allensbach, 87
Alps, L. D., south of, 205
Amber, 28, 151
Amiet, M., 272
Amphion, 287
Analysis of bronze imp., 363
Anca, Baron, 238
Anchor, 254
Andreas, St., 129
Animal remains, 27, 176, 197, 231
Annecy Lake, 288
Anzeiger, 272
Aosta, 238
Appendix, 393
Aeppli, Mr., 11
Apples, wild, 341
— cut in two, 340
— cultivated, 341
Aromatic plants, 342
Arona, 210
Arpion (fishing imp.), 49
Arrowaks, 143
Arrow-heads of bone, 147, 151, 230
— — bronze, 150, 161, 193
— — flint, 24, 54, 154
— — iron, 119, 142
Asphalt, 35, 53
Aubin, St., 280, 401
Auvernier, 153
Aventicum, 256, 284
Awls, 25 *et passim*

BAAR, 126
Baldegg Lake, 270
Balls of string, 52
Bardello, 217

BUR

Barley, 337
— bread not yet found, 338
— ears on corns, 351
Base of hut walls, 71
Bassy, 287
Bast and fibrous plants, 342
— manuf. of, 323
Bavaria, 378
Beauregard, 287
Beams at Marin, 240
Bears' teeth, 27, 175
Belotte, La, 287
Berlingen, 267
Bevaix, 280
Bex, 287
Bienne, lake of, 273
Bit of iron, 254
Blackberry seeds, 341, 349
Blancfond, 32
Boar mark on swords, 246
Boars' teeth, 27, 34, 175
Board flooring, Castione, 226
Bodio, 217
Bodmann, 96
Boelsterli, Rev. Jos., 270
Boii, 263
Bollingen sandstone, 19
Bone tools, 26 *et passim*
Bonstetten, Baron von, 185, 243, 283
Bourget Lake, 202
Boring of stone tools, 22
Borgo Ticino, 210
Bracelets of bronze, 140, 162, 166, 221
Brandenberg, Mr., 123
Bread of L. D., 48, 63
Bridge-like entrances, 33
Bronze cauldron, Marin, 240
Bronze, appearance of, 306
— time unknown, 306
— mould, 306
— objects, Cortaillod, 149
— — Ebersberg, 374
— — Meilen, 28
— — Nidau, 137
Buckles of iron, 255
Bullace stones, 349
Burial of dead, mode unknown, 305

CAP

CAP platted of flax, 330
Carrard, M., 198
Casola, 227
Castione, 222
Cattle stalled on L. D., 57, 297
Cavedoni, Prof., 237
Cazzago, 217
Celts of stone, *passim*
Cerchiari, Mr. J., 238
Cereals of L. D., 337
— same as in Egypt, 343
Chamblon, Mont, 168
Champ, Martin, 282
Cheseaux, 168
Chevroux, 282
Chez les Moines, 280
Clay balls at Wangen, 65
— covering of huts, 152
— flooring of, 297
Clément, Dr., of St. Aubin, 181
Clendy, 168
Clothes of lake colonists, 330
Coins at Marin, 256
Colombier, 280
Concise, 168
Constance, lake of, 87
Construction the same in three ages, 309
Conturbia, 214
Copper implements, 116, 219
Corbière, 282
Corcelettes, 168
Corn, 48, 62, 63, 337
Corn bluebottle, 340
Corn-crushers, 25 *et passim*
— varieties of, in older L. D., 337
Cornel cherry, 341
Cortaillod, 148
Cour, 286
Crannoges, Irish, 6, 380
Crannogs, Scotch, 389
Crescent moon figures, 305, 319
Crêt, 280
Cretan catchfly, 340
Crucibles, 54
Cudrefin, 283
Culinary vegetables, 340
Cully, 286
Cumarola, 237

DAVAT, Dr., 204
Daggers of bronze, 161, 282
Dehoff, Mr., 96
Delaborde, M. Charles, 202
Derschbach, 131
Desor, Professor, 185, 239
Despine, Baron, 202
Destruction of L. D., 310
— of Robenhausen, 47
Dingelsdorf, 96
Diodorus quoted, 251, 259
Division of labour, 178, 299
Dog in oldest L. D., 299

GAL

Dorei, 318
Donnino, Borgo San, 225
Dumont D'Urville, 318
Dyeing, plants used for, 342

EARLY Italian ant. (for comp.), 236
Ebersberg, 364
Egelsee, 72
Eich, 271
Einbaum, 147, 277
Embroidered cloth, 59
Epagnier Moor, 239
Ermatingen, 267
Escher von Berg, 364
Estavayer, 156
Etruscans, 207
Etruscan tombs, 237
Evian, 287
Explanation of the plates, 405

FÆCES of goats, &c., 46
Fagot-sticks, layers of, 69
Fascine dwellings, 69
Fehr, Mr. Wm., 219
Feldbach, 267
Felice, St., 221
Fellenberg, Von, on nephrite (*note*), 56
— — on bronze, 363
Fern, 342
Ferrules for lances, 251
Fibulæ of bronze, 221, 241
— of iron, 255
Fimon, Lago di, 222
Fish skeletons abundant, 297
Fishing a common occupation, 297
Fishing implements of bone, 67
Flax manufactures, 323
Flint implements, 23 *et passim*
— not abundant, 301
— saw, 24, 26
— use of, 301
— very essential, 301
Florida potters, 300
Font, 281
Fönwind, 47
Forceps, 9
Forel (station), 282
Forel, M., 194, 237, 286
— Dr. F. A., 194
Forest trees and shrubs, 342
Fowl, domestic, not found, 344
Franks, Mr., quoted, 258
Freudenberg, Dr., 220
Fringe of flax thread, 330
Fruits and berries of L. D., 340
Fungi, 342

GABEREL, Mr., 185
Gabiule, La, 287
Gaienhofen, 266
Gallo-Roman period, 309

GAM

Game abundant in prehistoric times, 297
— a chief article of food, 297
Garda Lake, 218
Gastaldi, M., 207, 210, 224
Gaulish inscriptions, 317
Geissboden Moor, 125
General form of L. D., 3
— remarks, 289
Geneva, 287
— lake of, 286
Geographical list of L. D., 264
Germ of seeds disappeared, 337
Glass bead at Ebersberg, 373
— — — Cortaillod, 151
— — — Nidau, 147
— — — Wauwyl, 83, 303
Glass rings and beads, Marin, 241
Gletterens, 282
'Gofio' of the Canaries, 339
Gold objects, Nidau, 142
Gozzadini, Count, 206, 322
Grape-stones, 349
Graphite, 144, 305
Graseren, 273
Greiffensee, 268
Greifswald, 379
Greng, 184
Grinding-stones, 24
Guévaux, 285

'HABITATIONS LACUSTRES,' remarks on, 393
Haftings of stag's horn, 19, 170
— — wood, 64, 65
Hagenau, 264
Hageneck, 277
Hagenow, F. von, 379
Hairpins of bone, 174
— — bronze, 159, 165, 183
— — horn, 183
Hammers of stag's horn, 113, 157, 171
— — stone, 22 *et passim*
Handles of pottery, 228
Hasenfratz, Mr., 73
Hatchets of bronze, 240
— — iron, 253
Hausstock black sandstone, 18
Hauterive, 279
Hearth-plates, 26, 227
Heer, Professor, 336
Hegne, 87, 265
Hemp not yet found, 326
Helvetii, 260, 263
Hemmenhofen, 266
Hermance, 287
Herodotus quoted, 315
Himeri, 38
Himmerich, 58
Hippocrates quoted (Phasis), 315
Historic times, L. D. existed till, 308
Hitrig, Professor, 316
Horæ Ferales quoted, 257

LAU

Horizontal beams, 16
Horn and bone implements at Ebersberg, 373
Hornstad, 266
Horn, stag's, much used for tools, 304
Human remains, 242
Hungary, copper implements (for comparison), 219
Hurling stones, 136
Hut walls of wattle and clay, 297
Huts, rectangular, 296

IM GAU, 60
Im Luterholz, 281
Implements of L. D. and graves identical, 311
Incisions on bones, 189
Index, 419
Inkwyl, lake of, 272
Introduction, 1
Irchel, 365
Irgenhausen, 87, 58
Iron, appearance of, 308
— celts or hatchets, 253
— objects, Marin, 242
— —, Nidau, 142
— —, Unter Uhldingen, 119
Isolino, 217
Ivrea, 213
Iznang, 265

JADEITE, 68
Jahn, Mr. A., 31, 243
Jardine, Sir Wm., 391
Jolimont, 228

KANINCHENINSEL, 278
Kemble, J. M., quoted, 257
Kempten, 39
King, Rev. C. W., on nephrite, 57, *note*
Knife, Gaulish, at Thebes, 276
Knives of bronze, 160
— — iron, 253.
Koller, 128

LACHMANN, Dr. Th., 103
La Crasaz, 156
La Creuse, 282
Lake colonists originally pastoral, 310
— — branch of Celts, 313
L. D. chiefly destroyed by fire, 310
— — inhabited the whole year, 345
— — in peat, 9
— — not magazines or temporary abodes, 314
— — south of the Alps, 205
Lance-head of bone, 177
Lattringen, 275
Laurent, M. Rabut, 202
Lausanne Museum, 198

LEA

Leather, 335
Lecchi, 221
Les Uttins, 168
Leuci, coin of, at Marin, 259
Ley, Mr., 96, 99
Ligerz, 278
Limmat river, 290
Linch-pin of iron, 254
Linen cloth, 329
— — with pile, 329
Linth Escher, Prof., 14
Lisch, Dr., 378, 379
Little Island, 271, 278
Livingstone, Dr., quoted, 17, 371
Lizard, figure of, 146
Löhle, Mr. Caspar, 60
Looms, 331
Lorenz, Mr., 220
Lorzetobel, 126
Lucerne, lake of, 147
Luissel, lake of, 287
Luterholz, 281
Lutry, 286
Lützelstetten, 96

MAINAU, 265
Mainland colonists the same, 312
— — settlements, for comparison, 364
Majolica, 209
Maker's marks on swords, 246
Mallet of oak, 75
Mammern, 266
Mänedorf, 268
Manufacture of flax, 323
— — flint implements, 36, 86
Margrethen, 272
Mariazell, 271
Mariera, 225
Marin, 239
Markelfingen, 87
Martino, San, 215
Massilian coin at Marin, 259
Mats of flax and bast, 327
Mauensee, 272
Maurach, 115
Maxwell, Sir Wm., 391
Mealing stones, 25 *et passim*
Meander pattern, 155, 191
Mecklenburg, 378
Meilen, 14
Mercurago, 210
Merian, Mr. Edward, 367
Messikomer, Mr. Jacob, 38
Methods of collecting antiquities, 9
Millets, 337
Mistletoe, 342
Modena, 222
Monruz, 280
Montellier, 190
Moon images, 319
Moossedorfsee, 31
Morat, lake of (Murten), 283

PIL

Morges, 194
Möringen, 275
Morlot, Prof. v., 198, 224, 286
Moro, Prof., 210
Mould for casting celts, 195
— — — combs, 231
Mühlberg, Prof., 123
Müller, M., 134
Murten Lake (Morat), 283

NAGER, Mr., 77
Nationality of lake colonists, 313
Needles of bone, 174
— — bronze, 140
Nephrite, 16, 18, 56, 303
Nernier, 287
Nets of string, 328
Neuchâtel, lake of, 279
Neuenburger Horn, 266
New Zealanders' stone tools, 22, 293
— — boats and houses, 294
Nicolucci, Mr., 238
Nidau, 132
Niederwyl, 69
— not burnt, 71
— sketches of, 76
Nottwyl, 272
Nussbaumen, lake of, 268
Nussdorf, 105
Nuts of L. D., 341
Nyon, 287

OBERSTAAD, 266
Oil-producing plants of L. D., 341
Origin of Marin antiquities, 256
— of Terramara beds, 234
Original design of L. D., 291
— discovery of L. D., 10

PACKWERKBAUTEN, 69
Panixer Pass sandstone, 18
Pâquis, 287
Parisii, coin of, at Marin, 259
Parma, 222
Pears not common, 340
Pennino, Il, 212
Perforated earthenware vessels, 145, 154, 193
Peschiera, 218
Peters Island, 277
Pfäffikon, 58
— lake of, 37
Philippus money at Marin, 259, 260
Pictet, Gaulish inscription, 317
Pigorini, Mr. L., 224
Pile dwellings, 3
Piles bent at Wangen, 64
— at Robenhausen slope to SE., 45
— sharpened by fire, 20
— — — stone celts, 20

Piles used in L. D., 295
Plants of L. D., 336, 348
— cultivated, vary, 347
— wild, same varieties as now, 346
Platform, general form of, 296
Platforms at Wauwyl, 78
Platted cloth of flax, 327
Pocket sewed on to cloth, 330
Pont de la Thiele, 283
Ponte dei Preti, 215
Poppy, garden or opium, 349
Port à la Reine, 169
Port Alban, 282
Port des Sarrasins, 282
Potter's wheel unknown at first, 28
Pottery of lake colonists, *passim*
— — Ebersberg, 368
— — Meilen, 28
— — Nidau, 142
— — Wangen, 66
Pourtalès, Count de, 184, 283
Prasias Lake, 315
Pré Fargier, 279
Promenthoü, 287
Pupikofer, Dean, 73
— Rev. Mr., 72
Pully, 286

RASPBERRIES, 341
Reggio, 222
Reichenau, 87
Relic-bed, 14
Remarks on 'Habit. Lacus.,' 393
— on stone, bronze, and iron ages, 12
Results of investigations on L. D. plants, 342
Riedbühl, 58
Rings of earthenware, 145, 177
Rive, 287
Robenhausen, 37
— sketches of, 37, 44
Rocchi, Prof., 322
Rochat, L. M., 168, 182, 183
Rolle, 287
Roman amphora, 183
— key, 121
— tiles, 133
Ropes of flax yarn, 324
Roseaux, Les, 198
Roseninsel, 378
Ruddle, 305
Rütimeyer, Prof., on animal remains, 356
Rye not found in Egyptian Monuments, 345
— — — in L. D., 345

SACKEN, Dr. F. v., 221
San Martino, 215
Saws of flint, 34, 171
Scarabelli, Dr., 238
Schenken, 271

Scheuss, 279
Schlattwald, 274
Schoolcraft, quoted, 136
Schwab, Col. Fred., 15 *et passim*
Scotch crannogs, 389
Scraper, 9, 10
Sections at Robenhausen, 42, 45
— — Wauwyl, 77
Seeds burnt, 336
— hollow inside, 337
— sometimes unburnt, 336
Seegrund, 43
Sempach, lake of, 270
Sempach station, 271
Sequani, coin of, at Marin, 259
Shell marl, 32, 43
Shield-handles and mountings, 252
Shirley, Mr., 388
Sickles of bronze, 162
Silber, Lieut. v., 220
Sinkstones, 146
Sipplingen, 119
Situation eligible for L. D., 295
Size of huts at Robenhausen, 46
Sling of flax plat, 151
Slingstones, 135, 166, 373
Soot, pottery coated with, 305
Spear-heads of bronze, 139
— — iron, 248, 274
Spelt, 337
— before David's time, 345
Spindle-whorls, 30, 66, 117
Spirals of bronze, 142
Spring corn, 337
Stag's horn implements, *passim*.
Staub, Mr., 129
Steckborn, 267
Stein, 266
Steinbergs, 132, 240
Stone objects, Allensbach, 89
— — Ebersberg, 372
— — Marin, 240
— — Meilen, 17
— — Robenhausen, 53
— — Wangen, 61
Stone, bronze, and iron indicate grades of civilisation, 313
Stoppani, Abate A., 217
Store-rooms for flax, 64
Strawberry seeds, 341
Strobel, Prof., 224
Structure of fascine erections, 70
St. Aubin, 280, 401
St. Prex, 286
St. Sulpice, 286
Stuart, Mr. John, 389
Substructure, 3
Superstructure, 7
Suter, Colonel, 77
Suter, Mr., 77
Sutz, 274
Swords of bronze, 176
— — iron, 242

TAB

TABLE of contents, ix.
Taubmühle, 266
Täuffelen, 277
Teeth of bears, 27, 175
— — boars, 27, 34, 175
Tectosagi, 263
Temporary occupation, theory of, 314
Tenivière, La, 169, 239
Terramara beds, 222
Thebes, Gaulish knife found at, 276
Thièle River, 239.
Thonon, 287
Thread and string of flax, 324
Thurgau, Hist. Society of, 73
Tiefenau antiquities, 243, 258
Tillage of lake colonists, 299
Tin ornaments on pottery, 148, 166
Tools of bone for pottery, 179
Torre Bairo, 215
Töss River, 365
Translator's Preface, v.
Trapa natans, 48, 341
Trefoil mark on swords, 246
Tresserve, 204
Troyon, Mr. F., 172, 181, 286, 393
Tulingic coin at Marin, 259

UBINOWA, 277
Ueberlinger See:
Eastern shore, 102
Western shore, 96
Uetliberg, 376
Uhlmann, Dr., 31, 189
Ullersberger, Mr., 104
Unter Uhldingen, 116
Use of stone celts, 20
Uttins, Les, 168, 281

VARÈSE, Lake of, 217
Vegetable fibre, flax, &c., 323
Venezuela, 318, *note*

ZWE

Verchère de Reffye, M., 247
Versoix, 287
Vicenza, 222
Vidy, 286
Villa Nova, 237
Vilters, 375.
Vingelz, 278
Viverone, lake of, 215

WALLHAUSEN, 96
Walter, Mr., 264
Wangen, 60
Water and marsh plants, 342
Wattled walls of huts, 153, 296
Wauwyl, 77
Weeds of the cornfield, 339
Weiler Hegne, 87
Weisser Grund, 32
Wilde, Sir W. R., 380, 381
Wild beasts, safety from, 291
Wilkinson, Sir Gardner, 276, *note*
Windisch, 376
Wooden objects, Robenhausen, 48
— seat at Wangen, 67
— utensils, Castione, 229
Workshop for flints, 36, 86, 97
Worsaae quoted, 17
Woven flax cloth, 329

YVERDON, neighbourhood of, 168
Yvoire, 287
Yvonand, 281

ZIHLBRÜCKE (Pont de Thièle), 283
Zug, 123, 131
— lake of, 123
Zürich, 269
— lake of, 269
Zweieren, 131

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